RAILROAD GAZETTE

FRIDAY, DECEMBER 13, 1895.

CONTENTS

Contributions.

A Word Concerning the Car-Wheel Business.

TO THE EDITOR OF THE RAILROAD GAZETTE:

. . . I am afraid you are under a wrong impression in regard to the condition of business in railroad supplies, at least so far as car wheels are concerned. Notwithstanding the fact that Lake Superior charcoal pig iron has advanced in price during the past six months from $4 to $5, the price of car wheels has advanced very little, if at all. This is due to the fact that nowadays a very great proportion of the material going into ordinary car wheels is not charcoal iron at all, but foundry iron, or scrap of the poorest description mixed with ferro-manganese. The number of wheel makers who are using charcoal iron exclusively in their wheels is very small indeed, and the competition induced by the material used as above has really brought the chilled wheel business for some roads to a worse condition than it has ever been in before. At the present moment I know of a number of railroad companies who are buying wheels for considerably less than a cent a pound, and who would, without the slightest delay, change their business from makers who have supplied them for years if every concession in price made by competitive makers was not met by those who supply them. There are of course a number of railroads who are not doing their business on this principle; but so many of the large railroads are, that the average wheel maker nowadays has very little money left to put into anything but the actual expenses of operation. It is on the whole a disappointing condition of affairs, for the railroads are certainly not profiting by the quality of wheels they are getting, and it will, of course, lead to another general tirade against the quality of chilled wheels, such as we had a number of years ago, when practically the same conditions prevailed, although on a considerably higher range of prices.

The advent of the electric railroad has introduced new conditions for some wheel makers. The conditions of service are so different on roads of this class, as compared with steam railroads, that while the competition in prices is growing more and more every day, still the matter stands in quite a different light. The electric railroad is solely concerned with the wheels it buys, and not with the wheels that other companies buy. The steam railroads, on the other hand, receive fully 50 per cent. of the wheels they pay for, through the hands of other companies who supply them under the Master Car Builders' rules; and even if a steam railroad were disposed to buy a good quality of wheel it would have to take the position of buying one quality for use under its own cars and another quality for the cars of other companies, and as a rule they will not do any such thing. Again, so many companies are willing to buy wheels at the lowest possible price, with the intentien of making a little money on charging them out under the Master Car Builders' rules, that the premium on poor material and workmanship is growing higher every day.

If the railroad officials, or any other parties interested, would look into the matter themselves they would find in nearly all car wheel works in the country at least 75 per cent. of the material used made up of No. 3 mill or gray forge iron and the cheapest description of scrap, including malleable iron, plow points, burnt grate bars, etc., the whole going into the cupola accompanied by a certain proportion of ferro-manganese to add strength and chilling qualities to the mixture. The ferro-manganese, of course, fulfills its purpose in a measure, although the very small proportion added is not likely to become uniformly distributed throughout all of the material, and consequently a considerable number of wheels are turned out of the most dangerous quality for use. The position, in fact, of a wheel maker who desires to at least carry out the practice of some years ago, or to improve on it in any measure, is, I must say, discouraging, provided he looks solely to the steam roads. It is beyond my understanding why railroad officials, in such a matter as a car wheel, will absolutely refuse to interest themselves in any way beyond the mere question of the price at which they can buy the wheels. The guarantee has become a farce, as after an institution selling wheels which will not meet the guarantee has had enough of it, they simply make a change in their organization, and the guarantee of, course, is done away with.

CAR WHEEL MAKER.

Air-Brakes on Freight Trains.

The Lake Shore & Michigan Southern Railway Co.,
CLEVELAND, O., Dec. 7, 1895.

TO THE EDITOR OF THE RAILROAD GAZETTE:

After reading the editorial comments in the *Railroad Gazette* for the past two weeks, in connection with the paper presented by me before the Western Railway Club on the subject of Air-Brake Equipment on Freight Trains, I am of the opinion that you have misunderstood somewhat the purpose in the mind of the writer in preparing the paper.

It was not my intention to discuss the subject of air-brakes from a general standpoint, or from the side which would in any way bring out and praise its good points or advantages. Very little need be said on that line, for the advances made possible by the use of modern air-brakes in railroad service, and the frequent prevention of accidents already accomplished by its use, render an essay in defense of air-brakes unnecessary, for everyone recognizes the facts.

It is very desirable, in the use of air-brakes on freight trains, that they be brought to the highest state of efficiency possible. As such use is with many roads a new feature, I believe that any information that can be given in the line, pointing out the dangers in the way, and throwing light on the obstacles over which others have stumbled, and the calling attention to dangers unseen by many, because they have not thought to look for them, all tends to bring the use of air-brakes to a higher state of efficiency.

I believe it true that people are not apt to either look out for or expect danger when taking a journey, as a result of listening to a lecture on the delightful scenery or the fine hotels en route, but if these delights are not mentioned, but on the contrary the perils from severe cold or from highway robbers are spoken of, it will result in their taking the precaution to have good warm clothing and a proper supply of fire arms or a guard to go with them, and thereby ward off any evils that otherwise would befall them.

In the paper on air-brake equipment on freight trains I have written with this principle in mind, and have hoped, by saying nothing of the good points, to so fully present the weak features that have actually developed in service, that attention would be drawn to them and some of the more glaring weaknesses, at least, be overcome.

In your issue of December 6th, you attributed a statement to me which I did not make, viz., that it is my theory that more accidents and more serious accidents take place with trains only partially fitted with air-brakes than with trains worked only by hand brakes. No such statement was made by me in the paper, but I did state that trains partially equipped with air, or having enough air-brake cars to control them without the use of hand brakes, are an *invitation* to more serious accidents, and in larger numbers, than were ever likely under the old regime where hand brakes were the sole dependence. This statement, I believe, is indisputable, and that was *one* of the reasons that caused me to present the paper before the Western Railway Club, so that before too many accidents of this kind should occur, precautions which are entirely feasible should be taken to avoid them. It is by no means necessary for serious accidents, in large number, to occur from the use of trains partially equipped with air-brake, provided there is proper care exercised in the condition of the air-brake equipment and in the manipulation of the air, but as there is a strong tendency to neglect these two features on some roads, I believed a strong word of caution was wise at this time.

A. M. WAITT, *Gen. M. C. B.*

The Southern Pig Iron Market.*

ITS EXTENT AND HOW TO IMPROVE IT.

The extent of the market for Southern pig iron is very remarkable. . . . There were produced in 1894 6,657,388 gross tons of pig iron, of which 120,180 tons were spiegeleisen or ferro-manganese, leaving 6,537,208 tons as all the iron produced in the United States for melting and puddling. There were also produced in the same year 4,412,032 gross tons of steel of various kinds. The production of this steel would require more than a corresponding number of tons of iron. But as my paper is a commercial and not scientific one, I am content to offset the above-mentioned tonnage of spiegeleisen and ferro against the waste incurred in conversion, and simply to deduct 4,412,032 tons of steel from the available tonnage, which leaves 2,125,176 tons available for foundry and forge purposes. This may be considered the American market during the restricted and unusual year of 1894, for the importations of pig iron from foreign countries were only 15,582 tons, consisting mainly of Scotch, including some Swedish pig iron.

The production of Alabama in 1894 was 592,392 tons, and of Tennessee, 212,773 tons, being 805,165 altogether. This production represents for Alabama 27.8% of the entire consumption of the United States of pig iron, apart from that used in the manufacture of steel; and for Tennessee a similar production of 10%, being for the two states an aggregate of 37.8%. This percentage is quite sufficient to show the commanding position taken by this district in the general foundry and rolling mill trade. This is emphasized by the wide area over which the iron is distributed. I give the following tables, showing the distribution of iron by the Tennessee Coal, Iron & Railroad Company for the calendar year 1888 and for twelve months ending June 30th, 1895.

SHIPMENTS OF PIG IRON.

Domestic. States.	1888. Jan. 1 to Dec. 31.
Ohio	65,561
Missouri	23,733
New York	22,495
Kentucky	19,808
Michigan	16,582
Illinois	16,193
Alabama	15,790
Tennessee	13,184
Indiana	9,599
Pennsylvania	6,777
Massachusetts	3,929
Iowa	2,300
New Jersey	1,820
Connecticut	1,505
Colorado	1,200
Rhode Island	818
Wisconsin	818
Louisiana	588
West Virginia	387
Kansas	384
Maryland	268
Nebraska	234
Texas	221
Mississippi	155
California	150
Arkansas	122
Minnesota	70
Delaware	36
Georgia	18
North Carolina	15
Total	224,634

Domestic. States.	1894-5. July 1. to June 30.
Ohio	136,487
Alabama	89,054
Kentucky	48,376
New York	44,690
Illinois	38,736
New Jersey	31,965
Tennessee	30,368
Missouri	29,851
Michigan	28,170
Indiana	28,047
Pennsylvania	27,215
Wisconsin	9,038
Maryland	4,748
Massachusetts	4,456
Iowa	2,251
Connecticut	1,950
Maine	1,925
Georgia	1,910
Texas	1,605
North Carolina	1,102
Kansas	1,034
California	842
Vermont	800
Oregon	685
Rhode Island	645
Louisiana	635
Minnesota	612
Virginia	580
Miss ssippi	560
Delaware	360
Arkansas	308
New Hampshire	295
District of Columbia	293
Nebraska	276
Colorado	158
Florida	60
South Carolina	57
Washington	50
West Virginia	18
Foreign.	
Canada	2,034
Mexico	357
England	250
Nova Scotia	40
Italy	17
Total	572,910

An examination of these tables shows the following interesting points:

1st. That the number of states consuming these brands of southern iron increased in the six years from 30 to 39, besides the addition to the last mentioned table of five foreign countries.

2d. That the home consumption had so far increased that Alabama moved up from seventh in progressive importance to second, and Tennessee from eighth to seventh. This is a point of supreme importance, for notwithstanding the fact that Birmingham iron ranges from Mexico to Canada, and from San Francisco to Liverpool, it is obvious that distant markets can only be controlled by the sacrifice of profits, and that it is to the development of the home market that can be reached without the payment of intervening freight charges that we must look for our profitable business.

Obviously, therefore, everything that the producers of pig iron in this district can do should be done to advance the interests of the rolling mills, pipe works, machine foundries, etc., who locate beside us. . . .

There are three ways in which the market for Alabama iron may be enlarged, namely, the development of (a) the home market, (b) the domestic, (c) the foreign.

For the enlargement of the home market, it is necessary to bring continually under the notice of manufacturers in other parts of the country the advantages which our cheap iron and coal, our mild climate and reliable labor afford. . . . Many of the largest consumers of our products have never been in the South, and their attention has not been personally directed to the consideration of the removal of their existing plants or the establishment of new ones. . . . It is needless to say that the chief direction in which our efforts should be united is to impress upon the producers of basic open-hearth steel the advantage to accrue to them from the consumption of our metal at the point of production, where, if desired, it could be furnished hot. With the establishment of such a plant, works for the production of boiler plates, sheets for tinning, bars for structural and bridge work, wire rods and railroad material will very speedily follow.

For the enlargement of the domestic market, the most desirable thing to be done in my judgment is to secure closer uniformity of grading and naming the iron and selling it upon terms of uniformity. It is very unsatisfactory to the consumer in Canada or Minnesota to buy one carload of forge iron for foundry purposes and next month to buy from another producer a carload of two soft and find that it contains less silicon and is less fluid. It is scarcely too much to say that the whole question of grading iron is assuming a more complex condition and that if it is not in a somewhat chaotic state, the minds of some of the graders have attained that undesirable goal. Harrassed by the pressure of evil times and the

* A paper by James Bowran, Esq., Secretary and Treasurer of the Tennessee Coal, Iron & Railroad Company, read before the Alabama Industrial and Scientific Society.

desires of consumers for something cheaper, efforts have been made not to "split hairs," but to split grades to a corresponding degree of fineness. This leads to an absence of physical or chemical demarcation and makes the question of grading depend more than ever on the individual opinions of the buyer and consumer, who somewhat naturally look at the question from different standpoints and arrive at different results. This leads to considerable friction, and in the long run Southern iron gets a bad name. With the organization, as before suggested, of strong local trade organization the names of grades could be definitely agreed upon and arrangements made for at least monthly or bi-monthly interchange of visits from one works to another, so that the members might agree on the maintenance of one common standard and correct discrepancies and divergencies from it.

(c) The question of developing a foreign market is one which will at some future day be one of very great interest. When prices of Birmingham iron were at the lowest notch in April, 1895, it was then possible to put iron for export f. o. b. ship at tidewater in Pensacola or Mobile harbor $2 per ton below the corresponding value of the cheapest English iron, and it was found practicable to lay down iron in Liverpool, grade for grade at less than the price of Middlesboro iron shipped across England to that point, the facts also developed that at these figures we would have for Alabama iron an exceedingly good chance to compete in all Mediterranean ports, very large quantities of iron being shipped from England to Barcelona, Genoa, Civita Vecchia and other Italian ports. This iron may be shipped in conjunction with steam coal or foundry coke. It would be an experiment of somewhat doubtful outcome as to whether the coke might not by the rolling of the vessel in an Atlantic voyage be unreasonably broken up in comparison with the shorter voyage sustained by English coke; but if not, then there is room for the shipment of Alabama coal and coke in competition with English into Mediterranean ports, although it is fair to say that there has not yet been any profit demonstrable in that business.

The main difficulty, however, in the development of a European market for our iron is and will be the command of marine tonnage; and any other business that can be grouped with pig iron, such as exportation to Spain or Italy of coal and coke, or to Genoa, Bremen or Havre of cotton will materially facilitate the solution of the difficulty. Whenever our prices for iron fall again to bring them below the parity of English figures, we should commence to work upon ship-brokers and get in touch with both regular established lines of steamers and also "tramp" steamers and sailing ships. The same remarks apply with as great force to the less important markets of Bombay, Calcutta, Melbourne, Yokohama, and others. These markets are dominated both in pig iron and in iron pipe, in coal, and in coke, by the English because of the present exchange of commodities which has doubtless settled steamers and sailing ships into certain marine lanes of travel, from which it will require patience and perseverance on our part to divert them.

Air-Brakes.

At the November meeting of the New England Railroad Club Mr. R. A. Parke presented a paper on Air-Brake Equipment and Its Relation to Rolling Stock. The title seems to us so general that we have thought it might be equally well covered by the two words which we have selected. We give below an abstract of Mr. Parke's paper, also a short abstract of a paper presented at the same meeting by Mr. E. G. Desoe and of the discussion on the two papers:

There is now a number of railroads that require every freight train to be under the exclusive control of the air-brake. Some roads have, in consequence, reduced the number of brakemen to two upon all through freight trains, regardless of their length, and in that way alone have effected an annual reduction in their operating expenses which covers all cost of operation and maintenance of the brakes and leaves a surplus of about 7 per cent. of the total sum expended in equipping their freight cars with air-brakes. Upon some railroads, where practically all freight trains are controlled by the air-brake, the average freight train speed has been increased 25 per cent. or more, so that a considerably reduced number of locomotives and cars and only about four-fifths the former number of train crews are required to handle a given volume of traffic. The capacity for safely handling a larger volume of traffic upon the same number of tracks has also increased almost proportionally with the increased speed, and fully so where block signals are used. The number and cost of accidents upon railroads operating all freight trains by the air-brake have been very materially reduced, this reduction being known in some cases to amount to as much as 50 per cent. or more. In addition, the cost of wheel renewals has been much reduced.

It may now be asserted that, by subjecting all freight trains to full control by the air-brake, the net earnings of a railroad may be annually increased to the extent of from 20 to 40 per cent. of the cost of applying the brakes.

In addition to its usefulness in freight service, the quick-action brake has, directly and indirectly, revolutionized the brake efficiency upon passenger trains. It has, on the one hand, materially reduced the distance in which heavy passenger trains may be stopped and, on the other hand, it has been the means both of forcing engineers to abandon many improper and dangerous practices, which had grown to be habitual, and of establishing a complete reform in the character of the brake gear. No one had hitherto fully realized the weakness and inadequacy of the brake gear in use, and it was not until it went to pieces under the energetic performance of the quick-action brake that a thorough investigation and complete reconstruction was inaugurated.

Investigation of the general character of passenger brake gear also brought to light a far too general neglect to properly take up the slack in the brake gear, resulting from wear of the brake shoes, and to otherwise maintain the brake apparatus in effective condition. The efficiency of the air-brake was, in many cases, completely destroyed through carelessness and neglect in these respects, and accidents were frequently found to have no other cause. The reform has effected a most gratifying improvement in the efficiency of the air-brake service. To-day the average stopping efficiency of the brakes upon passenger trains is far more than double what it was seven years ago, and the great advance in shortening the time of passenger service during the interval has only been rendered possible, with due consideration for safety, by this increased ability to stop trains quickly in emergencies.

The remarkably fast time which has become an established element in practical passenger service within the past three or four years has, however, developed a demand for even a better stopping efficiency than that assured by the ordinary quick-action brake, and this requirement has instigated a modification of the quick-action brake apparatus which decreases the length of stops from high speeds about 25 per cent. As no description of this modification has been published, and as its importance to the safety of fast trains is becoming liberally recognized, a brief sketch of the features peculiar to the apparatus will be given before a general review of present air-brake practice is undertaken.

The High Speed Brake.—It is evident that a much greater brake shoe pressure could be employed at high speed than at low speed without sliding the wheels, and this is the purpose of the modification of the quick-action brake which is now known as the "high speed" brake.

The high speed brake is, essentially, a quick-action air brake operating under a high air pressure. In emergency applications, it creates at first a high brake-cylinder pressure which is gradually and automatically reduced to 60 lbs. while the speed is being reduced, and in service applications it limits the cylinder pressure to 60 lbs. These results are effected by the use of an automatic relief-valve which is attached to each brake cylinder, and consists of a piston, a slide valve and an adjustable spring. The spring is so adjusted that the valve is inoperative when the air pressure in the brake cylinder is 60 lbs. or less. If, after the cylinder pressure has reached 60 lbs., the supply of air to the cylinder continues, but with no greater rapidity than occurs in any service application of the brakes, a large port in the relief-valve is opened and permits the excess supply of air to freely discharge from the brake cylinder to the atmosphere, so that no increased cylinder pressure occurs. In an emergency application of the brakes, however, the air is supplied to the brake cylinder so rapidly and in so much greater volume that the pressure rapidly rises above 60 lbs, and causes a longer travel of the relief-valve piston, whereby the large port of the relief-valve merely opens and instantly closes again, and the air is caused to escape from the cylinder to the atmosphere through a more restricted port, until the pressure has been thus reduced nearly to 60 lbs. When the pressure becomes reduced to 60 lbs., the further escape of air is cut off and that pressure is retained in the brake cylinder until the brakes are released from the locomotive.

As locomotives which haul high speed trains are generally also used in other kinds of service, it may be frequently necessary to change from the standard train pipe pressure of 70 lbs. to the high pressure and *vice versa*. In order that this change may be quickly effected, the feed-valve attachment of the engineer's brake-valve is removed and replaced by a flanged fitting, from which two small pipes lead to a bracket under the running board. This bracket supports two feed-valves, the one set at 70 lbs. pressure and another set for the higher pressure, and contains a three-way cock by which either feed-valve may be used as required. The pump governor is also supplied with a siamese and two diaphragms, one set at 90 and the other at 120 lbs. The small air pipe leading from the main reservoir to the 90-lb. diaphragm of the pump governor is supplied with a cock which is opened when a main reservoir pressure of 90 lbs. is used, and closed when the higher pressure is required. Of course, if the locomotive is used exclusively to haul trains equipped with the high pressure relief-valves, the ordinary arrangement of the engineer's brake-valve and pump governor fulfills the requirements by merely adjusting them for the higher pressures. The train-pipe pressure used with the high speed brake is from 100 to 110 lbs.

Experimental tests of the high speed brake have demonstrated the importance of the use of sand on the rails in all emergency stops. Not only is a better stop made, but in case of a bad rail the use of sand is practically a necessity to prevent the wheels from sliding with the high cylinder-pressure employed. It is highly desirable that the application of sand should be automatic, so that the movement of the handle of the engineer's brake valve is all that will be required of the engineer in emergencies. The reasons for this are the same ones that condemned the use of a separate operative-valve for the driver brake, when it was formerly employed as an emergency appliance. It is therefore urgently recommended that, in all cases where the high speed brake apparatus is applied, a track sanding apparatus shall be used which will operate automatically in every emergency application of the brakes.

Beside shortening emergency stops about 25 per cent., another important advantage in the use of the high speed brake is the ability to make more than one effective application of the brakes without recharging. The importance of this feature in fast train service was well illustrated by an incident which occurred some months ago. A train equipped with the ordinary quick-action brake was running at the rate of about 65 miles per hour when the engineer observed a block signal set against him. He had hardly obtained a full service application of the brakes before the signal cleared and he released them. The speed had not been perceptibly reduced, but the air pressure in the auxiliary reservoirs had been reduced to 50 lbs., and, before it could be restored, the train rounded the curve just beyond the block signal tower, and the engineer encountered a drawbridge signal at danger. An emergency application of the brakes was promptly effected; but, when the train stopped, the locomotive was within ten feet of the open draw. That train is now equipped with the high speed brake, and it is found that, immediately after a full service application and release, there is still sufficient air pressure to make a considerably better emergency stop than could at any time be made with the ordinary quick-action brake.

Still another advantage of the high-speed brake is the positive limitation of the brake cylinder pressure to 60 lbs. in all service applications, regardless of the train-pipe pressure used. Although the brake leverage is such that a cylinder pressure of 60 lbs. produces a 90 per cent. braking power, and this braking power is available in full service applications, not a single pair of wheels is reported to have been removed from the Empire State Express trains on account of flat spots during the two years that those trains have been equipped with the high speed brake apparatus.

Engine Brakes.—An influential factor in the improved stopping efficiency under present air-brake practice is the general use of brakes upon the driving wheels of locomotives. It is but a few years since a large majority of railroads either used no driver brakes at all or supplied them for use as an emergency appliance only. It is the present practice of nearly every railroad in the country to make the driver brake just as much a part of the regular train brake equipment as the brakes upon the cars, and serious attention has been given to the fact that upon most engines something more than the driver brake is required to make an effective engine brake. The proportion of the weight of locomotives which is sustained by the drivers may be roughly stated as follows:

For 8-wheel engines	65 per cent.
For 10-wheel engines	75 "
For mogul engines	85 "
For consolidated engines	90 "

The driver brakes of consolidation and mogul engines are generally very effective, because such a large portion of the total weight is utilized as a braking force. The driver brake of a 10-wheel engine acts upon only about 75 per cent. of the total weight, and the eight-wheel engine, which is the one most used for fast trains, affords the driver brake much the poorest stopping power of all. The eight-wheel engine with driver brake only is in precisely the same position as was the 12-wheel car a few years ago, when brakes were applied to only eight wheels; that is, it is supplied with but two-thirds the retarding power that it ought to have. The general reorganization of passenger brake gear, already mentioned, has happily included the application of brake shoes to the middle pair of wheels of six-wheel trucks, so that few 12-wheel cars are now running without brakes for all wheels. The prejudice which formerly existed against the use of brakes upon wheels of the engine truck has been exploded, with the result that many of the engines used in fast passenger service are now equipped with brakes upon the leading truck. In a very short time it will be well recognized that a reasonable regard for safety requires the use of the engine truck brake. The promptness with which it has been applied to many of the engines of fast trains sufficiently indicates that it is already considered necessary to the safety of that class of passenger traffic.

Passenger Car Equipment.—Concerning the air-brake equipment of passenger cars, there appears to be little to add to what has already been said. There is one feature, however, which deserves consideration. It has become necessary to make some provision for larger brake cylinders upon heavy cars. In order to meet the requirements of the heaviest 12-wheel cars, a brake apparatus which included a 14 in. cylinder, was designed some years ago. Inasmuch as this size of brake cylinder is required for 12-wheel cars, its use upon heavy eight-wheel cars has the advantage that no additional complication in brake apparatus is introduced, and no increased stock of repair parts is necessary. It is, therefore, now being applied to many of the heavy eight-wheel passenger cars. There are some objections to the use of so large a cylinder upon an eight-wheel car. Its capacity is double that of the 10-in. cylinder, and it is therefore larger than is necessary. It is also necessary to cut down the brake leverage in proportion to the increased power of the large cylinder. While this has the advantage of practically wearing out a set of brake-shoes without taking up the slack, it also requires that the slack shall not be taken up so closely that too short a piston travel results, as this causes an unusually high cylinder pressure, and wheel sliding may occur in consequence. There has been a demand in some quarters for a size of brake cylinder intermediate between the 10-in. and 14-in. sizes, and the design of a 12-in. cylinder apparatus is now about completed. This will soon be on the market for those who prefer it to the 14-in. cylinder apparatus for heavy eight-wheel cars. There is no doubt that the 10-in. cylinder brake reaches the limit of its best usefulness upon cars weighing about 50,000 lbs., and heavier cars should be equipped with a brake cylinder of larger size.

In Freight Service.—In applying air-brakes to old freight cars, there are several incidental ways of reducing the cost, which usually make themselves manifest when the number of cars is considerable and the work is continuous. There is one simple and effective means of cheapening this work, however, which is worthy of careful consideration at the present time, when so many railroads are beginning an extensive and systematic application of air-brakes and automatic couplers. The chief disadvantage under which the work of applying the air-brake to freight cars is usually carried on, is the scanty room beneath the car in which to do the work. It is rare that the tracks used for car repairs are provided with pits, and the advantage of elevating one or more of the repair tracks for this purpose can therefore hardly be over-estimated. It is an exceedingly simple matter to raise the track from 2½ to 3 ft. and thereby very greatly facilitate the application of the air-brake apparatus and all changes in the brake gear. It has been satisfactorily done by placing 12-in. timbers longitudinally beneath the rails and constructing a short inclined approach. The space between the timbers is free of obstruction, so that the men move freely about under the car and stand up at their work.

Brake Shoe Metal.—The foundation, upon which the whole superstructure of the brake system rests, is the frictional resistance to the rotation of the wheels that is caused by the forcible application of the brake shoes, and it would be a serious oversight to conclude this paper without a reference to the valuable information that is promised by the practical investigation of brake-shoe friction which is now being carried on Just how much difference there is in the friction-producing qualities of different shoes upon the same wheel, or of the same shoe upon different wheels, has never been satisfactorily determined, and the effective operation of brakes has suffered much in consequence. The report of the Master Car Builders' Committee on Brake Shoe Tests, which was presented to the Association last year, indicates that the friction-producing qualities of different kinds of brake shoes now in regular service vary to such an extent that satisfactory results cannot possibly be expected from some of them if they operate under the same brake-shoe pressures that are required with others. A reasonable perfection in the performance of power brakes seems to depend upon the ultimate selection of a tandard metal for brake shoes.

It is to be earnestly hoped that the committee will receive the most liberal support, as further progress in the improvement of air-brake apparatus will be seriously retarded until the enormous task which the committee has undertaken is completed. The development of the mechanical apparatus employed to produce the pressure of the brake shoes upon the wheels has already reached a stage of comparative perfection that seems almost absurd, in view of our ignorance of the actual service that it should properly perform.

AIR-BRAKE EQUIPMENT, ETC., BY MR. E. G. DESOE.

There is no one thing that is of so much importance on a train to be controlled by air-brakes as that of having

open communication from engine to rear air car through the train line. A stoppage may occur by some foreign substance in the piping becoming lodged in the hose coupling or strainer, or in the winter by wet snow getting into the couplings, when brake is not in use, and freezing. While the above causes are liable to occur and cause a stoppage, the most common one we have is by the closed angle or stop-cock placed in the train line at either end of a car. This may occur by carelessness of not opening, or it may be closed by carelessness or some malicious person after opening, or by some object striking the handle; and lastly, but by no means an uncommon thing, on freight cars, work closed by the deadwood or head block getting loose and bearing on the angle-cock key compress the key spring, and then, by working back and forth when train is moving, cause it to close. The train pipe becoming loose so as to vibrate and cause the key in an angle-cock to come in contact with the car will work it closed also. Great care should be taken to place the stop-cock so that no part of the car getting loose will interfere with it, and fasten the train line firmly, also use a style of stop-cock that the handle is not likely to be struck and thereby closed.

I would recommend the placing of a conductor's valve, and air gage, in freight cabooses, that the conductor may observe the train line pressure, and stop the train by the use of the valve before the pressure gets so low that it cannot be stopped by the air-brakes, as might be the case if a stop-cock had worked closed, or some other stoppage occurred in the train line, and the air leaks off in rear part of train slow enough not to set the brakes.

Another thing of great importance when equipping freight cars with air-brakes, and one hand wheel used (and I would recommend the use of only one), is to have it work with the hand-brake; that is, when the air-brake is applied, instead of its pulling the chain from the brake staff, it should push it up to it. This is of importance, because when equipped wrong it is dangerous for trainmen to use the hand-brake; and if used in connection with the air it does not add to its power, and unless there is more power developed than what the air is furnishing, there is no increase of brake power.

I think a freight car should be equipped so as to have a brake power of 90 per cent. of its light weight, on account of there being so much difference in the weight of an empty and a loaded car. There are a great many cars in service, the light weight of which is 30,000 lbs., with capacity of 60,000 lbs.; and with braking power 20 per cent of its light weight, obtainable only with 60 lbs. pressure of air in brake cylinder. With 70 lbs train line and auxiliary pressure, to obtain 60 lbs. in brake cylinder the application must be a full emergency, and the piston travel not over 8 in. Assuming we obtained the 60 lbs. pressure, we would then have a braking power of only about 23 per cent. of the car's weight when loaded to its full capacity; should a service application be made, with 8-in. piston travel 50 lbs. is obtained in the brake cylinder; this would give, with the car empty, a braking power of about 58 per cent., and when loaded of about 19 per cent. If a partial service application of ten or more pounds reduction has been made, when an emergency arises, then 19 per cent. of loaded weight and 58 per cent. of the light weight is all the braking power that can be obtained. The reason of this is that after a service application of ten or more pounds reduction has been made, there is no perceptible gain from train line air entering the brake cylinder. This means a loss in braking power from what should be obtained by a full emergency application, on a car weighing 30,000 lbs. and braked at 70 per cent. of 3,600 lbs. per car, or 180,000 lbs. for a 50-car train. Should the brake power be made 90 per cent. of the light weight, then we would have on this same car with a full emergency application a braking power of 30 instead of 23 per cent. of its loaded weight, a gain of 7 per cent., which would be about 6,000 lbs. per car, or 300,000 lbs. on a 50-car train.

Another thing of importance in equipping a car with air-brakes, and more so than many think, is the size of the brake cylinder; for any amount of brake power cannot be obtained by leverage with a limited piston travel. I have here a table taken from a committee report on Foundation Brakes, read at the Second Annual Convention of Railroad Air-Brakemen, held at St. Louis last April, in which the cars of various weights have been classified, and which shows the proper size of cylinder for each weight of car; also the total leverage, total piston travel and brake shoe clearance had in each case.

FOR PASSENGER CARS.

Weight of car.	Braking force 90 per cent.	Cylinder. Diameter.	Cylinder. Stroke.	Cylinder. Pounds per sq're inch.	Cylinder. Value.	Leverage.	Total piston travel.	Adjustments to wear shoe 1½ in.	Shoe clearance brakes off requiring 4-in. piston travel.
		In.	In.				In.		In.
10,000	9,000	6	8	60	1,700	5.29	12	2	.75
15,000	13,500	6	8	60	1,700	8.5	16 8	3	.52
16,000	14,400	8	12	60	3,000	4.8	11.16	2	.833
35,000	31 500	8	12	60	3,000	10.5	20.	4	.38
36,000	32,400	10	12	60	4,700	6 9	10.32	2	.58
49,000	44,100	10	12	60	4,700	9.38	18.	4	.426
50,000	45,000	12	12	60	6.800	6.61	14.	3	.6
70,000	63,000	12	12	60	6,800	9.26	17 82	4	.431
71,000	63,900	14	12	60	9.200	6.94	14·4	3	.576

FOR FREIGHT CARS.

	70 per cent.								
15 000	10,500	6	8	60	1.700	6.2	13.28	3	.615
16,000	11.200	6	12	60	3,000	3 73	9.6	1	1.00
50,000	35,000	8	12	60	3,000	11.8	21.2	5	.34

It will be seen by it that passenger cars weighing 50,000 lbs. or more should not use a 10-in. cylinder, and yet they are being put on cars weighing much more quite frequently of late, and trouble is experienced, where the proper braking power is given the car, in maintaining a low piston travel, and having the shoes clear the wheel, so as not to rub when brake is off. Especially is this difficulty experienced when wooden beams are used that deflect considerably.

A car weighing 60,000 lbs. braked at 90 per cent. would require the power of a 10-in. cylinder multiplied 11 $\frac{43}{100}$ times by leverage. This means that in order to obtain 1-in. movement at the shoes we must have a piston travel of 11 $\frac{43}{100}$ in., providing we have no lost motion. If we allow ½ in. clearance of the shoes from the wheels when brake is off (which is not any too much to prevent them from sometimes rubbing on account of not hanging true, and the beam spring taking more slack on one side than on the other), and the beams deflect $\frac{3}{16}$ in., our shortest piston travel will be, with the car standing 7 $\frac{89}{100}$ in., and this would give a travel of about 9½ in. when running, for it is generally allowed that a piston will travel from 1 to 1½ in. more when running than when standing. It will readily be seen that cars which multiply the power through leverage as described must be watched carefully, and the slack frequently adjusted, or the piston will find the cylinder head. As 8 in. is the piston travel which gives the pressure, at which the power of the cylinder is figured, then with a greater piston travel than 8 in. we do not obtain the braking power intended; thus the reasons for multiplying the power of a cylinder by leverage, only a limited number of times, as shown by table.

It is my opinion that we have reached a stage where the use of air-brakes on freight trains is a source of *danger* as well as safety. Any number of air-brakes in use on a train makes it safer for that and other trains to run over the road, and should always be used; but a train partly equipped with air-brakes may, by a sudden application of shoe-brakes, cause a severe shock to the train, as is illustrated every few days in practice, which is liable to cause injury to a trainman and damage to freight and cars. This sudden application may be caused by breaking apart, bursting of a nose, poor judgment on the part of the engineer in using the brake, and lastly by defects in the brake which cause an emergency application when the engineer uses the service notch. Besides the liability of a partially equipped train causing damage, there is a continual expense to switch these cars to the head end of a train; and it seems to me it would be economy for the railroads to complete the equipping of their cars as quickly as possible, thereby stopping the expenses of switching such cars to the head end, and save damage caused by running partly equipped trains.

DISCUSSION.

Mr. PARKE: I was impressed with one recommendation which Mr. Desoe suggested to-night, and I do not like to neglect the opportunity to suggest that there are quite a number of things to be considered in reference to the use of 90 per cent. braking power on freight cars. The standard braking pressure for passenger cars is 90 per cent., and the standard for freight cars is 70 per cent.

There seems to be a very considerable discrepancy which has more than once led to serious discussion as to whether the 70 per cent. limit could not be raised. Mr. Desoe suggests that it ought to be 90 per cent. There are several adverse considerations that are not difficult to understand, although it is at present difficult to show them in degree. It will be readily understood, I think, that where a car is moving the effect of its momentum should be considered. If we assume that this piece of paper is the moving car body, and we suddenly apply a retarding force at the bottom, the momentum of the car body, acting at its center of gravity some distance above the bottom, tends to tip it forward. This tendency causes a heavier pressure upon the forward truck and relieves the rear truck of some pressure. There is much less difference with a passenger car than with a freight car, principally on account of the difference in wheel base.

The next thing to take into consideration is the effect of the inertia of the car, as applied at the center plates of the trucks. The force applied by the car, in virtue of its inertia, to the center plate of the truck, acting against the resistance of the rails to the motion of the truck, tends to tilt or overturn the truck, and that tendency is measured by the magnitude of the force, by the height of the face of the center plate from the rail, and by the wheel base of the truck; the shorter the wheel base, the greater the tendency to overturn. The rear truck of the car, therefore, carries considerable less weight than the forward truck, when the brakes are being applied: and, further, the rear wheels of the rear truck carry to the rail considerably less than half the reduced weight upon that truck. The weight carried to the rails by the rear wheels of the rear truck, during brake application, is sometimes as low as 80 per cent. of the normal weight. It would hardly do, therefore, to apply to those wheels a braking pressure of 90 per cent. of the weight which they normally carry to the rail.

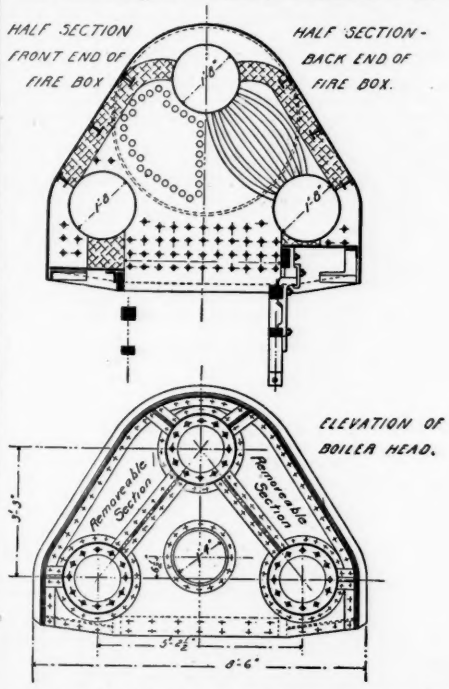
Another possibly important consideration I offer with some diffidence, because it has yet to be fully determined by the Brake Shoe Committee. They have, however, already found sufficient evidence in regard to it to permit me to suggest it in this connection. It is found that a certain pressure of a brake shoe upon the wheel causes a certain resistance to the rotation of the wheel. If that pressure be divided by two, considerably more than one-half the friction is obtained; that apparently means that if you undertake to apply a 90 per cent. brake pressure to a light car, viz., a freight car, it will result in a good deal more friction in proportion to the brake pressure than when a 90 per cent. brake pressure is applied to a heavy car, viz., a passenger car. Now it is interesting to know that actual experiments show that, with a calculated braking force of 70 per cent., the rear pair of wheels sometimes slides upon dry rails just before the car comes to a stop. When the Master Car Builders decided upon a 70 per cent. braking pressure for freight cars, it was only after that matter had been very carefully studied and experimented upon; and they found that if a greater brake shoe pressure were used, it would be apt to slide wheels when the car is empty.

PROFESSOR ALLEN: I was especially interested in the point which Mr. Parke brought out in relation to the use on freight cars of 70 per cent instead of 90 per cent., that in braking a train a greater proportion of the weight was brought on the forward trucks, and to the further point, that a greater proportion of weight was brought upon the forward wheel than upon the rear wheel of each truck. It seems to me that it is not easy to get rid of the difficulty he speaks of, so far as the greater proportion of the weight on the forward truck is concerned; but it seems to me that it is possible, theoretically, at least, to get rid of the difficulty as far as the forward wheel of each truck is concerned. I remember several years ago Mr. Parke wrote a paper, which I saw in the *Railroad Gazette*,* in which he called attention to "Some Unconsidered Elements in the Action of Brakes." He called attention to the fact that the pull on the rod is horizontal instead of normal to the wheel; taking this into account and combining with the effect of the friction between the brake-shoe and the wheel, he found that the actual pressure normal to the wheel was not ordinarily the same on the forward as on the rear wheel; and in that paper he showed how it was possible, by arranging the position of the hangers, to bring the same pressure upon the forward wheel as upon the rear wheel of the truck. Now, it seems to me that if it is possible, by arranging the position of the hangers, to secure *equal* pressures on both wheels, then it is possible to arrange those hangers in such a way that the pressure on the forward wheel of the truck shall be *greater* than upon the rear wheel of the truck, and greater by the amount that you want to have it. It seems to me possible to arrange the position, or angle, of the hangers just right, in order to bring about the result that you wish to have; to secure just the difference required in the amount of pressure, as well as to make it greater upon the forward wheel than upon the rear wheel. Difficulty will exist, of course, on cars now in use with brake hanger as now attached, and if you should attempt to use more than the 70 per cent. with them, perhaps somewhere on the train you would cause a rear wheel to skid when its front wheel did not. If the matter is worked up right, it is possible to avoid that part of the difficulty resulting from the difference in pressures on the two wheels of the same truck.

*Oct. 24, 1890.

Wide Fireboxes.

At the October meeting of the Western Railway Club, Mr. J. Snowden Bell presented a valuable paper on the subject of wide fireboxes for locomotives. The paper is, we should suppose, by all odds the most complete monograph on this subject that has ever been compiled, particularly in its historical aspect. We had hoped to make a considerable reprint of the paper before this time, but conditions have prevented. At the November meeting the paper was discussed at some length, and a brief report of the discussion appeared in the *Railroad Gazette* at the time. We have now the printed discussion, extracts from which follow.



Mr. Forsyth's Suggestion for a Water Tube Boiler for Locomotives.

Mr. GEORGE CUSHING: Some experiments which at one time I had occasion to go through with on the Reading road indicated that the grate in the Wootten boiler might easily be made too large for the flue area, and that, in wide fireboxes, the flue area is important to consider, in fact cannot be successfully greatly disproportioned. This refers to engines then in passenger service with cylinders varying in diameter from 18½ in. to 21 in., and with boilers of the Wootten type in all respects the same, except that in the case of 18½-in. cylinders, the grate area was 68 sq. ft. and in 21-in. cylinders 76 sq. ft. The flue area in each case was the same, 446 sq. in. The result may, at this time, be easily imagined. Mr. Mitchell, of the Lehigh Valley, had in 1887 designed wide fireboxes, but with less area of grate than the Wootten. I think they had about 60 sq. ft. of grate. These, with ample flue openings, were quite a success in anthracite coal.

The chief objection usually made to the Wootten type of boiler, by mechanics, is its large staybolt area, and the repairs made necessary in renewals of broken staybolts. And it is true, I think, that they do require much more attention than boilers of the Milholland type. But the Wootten boilers were, or are, useful in the burning of low grade fuels. This has been shown on other roads than the Reading. The Northern Pacific Railway made a trial of Wootten boilers in 1880-1 with lignite fuel; and the Union Pacific also, at a later date, with "refuse of mine" fuel. In each case the fuel was successfully used. But such large quantities of it were necessary, and the cost of renewals of staybolts, tubes, and fireboxes was so great, as to discourage continued use of the

boilers in alkali water districts, where only the low grade fuels were locally available.

MR. WM. FORSYTH (C., B. & Q.): Mr. Bell in the first part of his paper raises the question whether a wide firebox and a large grate area are desirable. In the last part of his paper he says: "As we have more stay-bolts in a large wide firebox than in a small narrow one, we will naturally have more broken ones." I will discuss the paper briefly from these two points; first, as to whether a wide firebox and a large grate area are desirable, especially with the bituminous coal, such as we have in Illinois and Iowa.

The size of the grate is to be regulated by the intensity of combustion necessary for the production of the steam required. Now we have up to the most intense combustion in a small locomotive firebox, when it reaches as much as 200 lbs. per square foot of grate per hour. That was the demand made on our engines last winter in the fast express service. We had 25 sq. ft. of grate area, and the consumption of coal was at the rate of 5,000 lbs. per hour, which you see is a rate of combustion of 200 lbs. per square foot of grate per hour. Then the question was this: What is the proper grate area for the combustion of 5,000 lbs. of bituminous coal per hour? Judging from the numerous tests which have been made, showing that the econony of coal burning decreases as the rate of combustion increases above 100 lbs. (or perhaps above 60 lbs. with low grade fuel), we decided that about 100 or 125 lbs. was as high a rate of combustion as we ought to have. And in designing this new firebox [No. 590] shown [in the *Railroad Gazette* Dec. 6, p. 799], we have a grate nearly 9 ft. long and 5 ft. wide, or 45 sq. ft., which would give us about 112 lbs. per square foot of grate per hour. That, it seems to me, is the method of arriving at how wide or how large a firebox should be; it should be governed by the requirements of the engine, and so as not to have a greater rate than 100 or 125 lbs. of coal per square foot of grate per hour. Mr. Bell says that in making boilers attention has principally been paid to enlarged heating surface, which is obtained largely through the tubes; the heating surface has not grown in proportion to the larger grate surface. In the Wootten boilers, which are so wide, the heating surface, to absorb the large amount to be burned on this grate, has not increased nearly as rapidly as the grate has increased. Now, in getting large capacity in a locomotive, we have, I think, nearly reached the limit to which we can go in a production of steam with these large boilers without enormously increasing the weight with the ordinary type of locomotive boiler.

Recently Mr. Yarrow, in England, has built some torpedo boat destroyers, in which he has used water tube boilers. In torpedo boats themselves he first used locomotive boilers, but when a speed service was required of 35 miles an hour he resorted to the use of a water tube boiler; and they are also used in the various navies of the world where a large capacity is required in a compact space.

It seems to me that in the development of locomotive boilers requiring much larger steam capacity, that a water tube boiler might be made to be successful, and I have made a plan of something of that kind, in which I obtained a heating surface in the firebox of 579 sq. ft., which is from four to five times the heating surface in an ordinary locomotive firebox. In this design also there are no staybolts, except in the front leg, and the firebox can be made as wide as the road limits will allow, so that, although that design as it is may not be entirely practicable for locomotives, yet it meets the requirements of a large grate, of dispensing with staybolts almost entirely, and of providing an increase in heating surface much larger than the grate surface is increased.

MR. GIBBS (C., M. & St. P.): We have had very little experience with large grate area boilers except one or two of the extreme shallow firebox type on top of the frames, and with those we have not had very satisfactory experience in burning our coal. The type of boiler used in the Chicago, Burlington & Quincy locomotive (No. 590) is, it seems to me, the best that has been brought out, up to date, to cover the requirements of large grate area and other necessary conditions for perfect combustion with Western coal. I decidedly prefer it to the one shown on the next page of our October *Proceedings*, which is of the ordinary type of shallow firebox on top of the frames, with the front leg depressed. The engine I refer to is one in use on the Chicago & Northwestern road. It is seen in comparing these two fireboxes that the box in the Burlington engine is only about 8 in. longer, and yet it has about 50 per cent. larger grate area than the C. & N. W. style. In other words, the C., B. & Q has 44½ sq. ft., as against 26½ for the Northwestern. Therefore, it is possible to get large grate area and a much better proportion of grate for firing with the Burlington type than with the Northwestern. The proportions adopted in the Burlington engine for grate area are, I think, about right for the heaviest type of passenger engine, although excessive for anything but continuously heavy service. I find that our passenger engines, having about 18 sq. ft. of grate area, frequently burn over 200 lbs. of coal per square foot of grate area per hour. We have found the economy of combustion under these conditions to be very low. With the Burlington engine, at 44 sq. ft. of grate area, the rate of combustion would be 90 lbs. for the same amount of steam producing power. I agree with Mr. Forsyth that from 100 to 125 lbs. is the proper amount to burn for best all around conditions with our Western coal. By going below that you can get slightly better evaporative results per ton of coal, but other conditions come in then in maintaining a proper state of incandescence of the fuel and proper covering of the grate, which makes it inadvisable to go below about 100 lbs. at any time as a minimum for heavy service.

MR. JACOB JOHANN (C. & A.): I had some years ago two of those Wootten boiler engines—when I was on the Wabash road. We had them for a very short time only, and while they steamed very freely and performed very well, at that time we were busy and did not keep any accurate accounts of the consumption of fuel, consequently I am not able to say anything intelligently on the subject. The principal objection we had to the boilers was that we could not keep them tight. About every 500 or 1,000 miles, we had to stop the engines and uncover the top and calk them all over. There seemed to be an inherent weakness in the boiler, so that it was almost impossible to keep it steam tight. I presume that this is a mechanical weakness that has been overcome by this time, but in those boilers, which were of the earlier type, it certainly existed. From what little practice I have had I am rather disposed to believe a deep firebox for bituminous coal is decidedly preferable to the shallow box in the matter of maintaining flues. With the shallow box the flues are more certainly subject to leakage than with the deep boxes.

MR. G. W. RHODES (C., B. & Q.): In 1881 the C., B. & Q. purchased a couple of Wootten firebox consolidation engines, and we had them in service for about 10 years, and finally decided that they were not an engine suitable for our work, and after renewing the firebox of each engine twice we converted them back into the ordinary type of consolidation engine firebox. We decided that they were not suitable for the road. The principal reason was that we did not have the coal. Another reason was that the engines were very expensive to maintain. The fireboxes gave out in about half the time that the ordinary firebox would, and the repairs from broken staybolts were constant. The water that we use out in the West is largely responsible for this. It has an entirely different effect on boilers from the waters used in the East, and perhaps I cannot illustrate this in any better way than to call your attention to the fact that in the East a set of boiler tubes will last in a locomotive boiler, without taking them out, from 10 to 11 years (the late Mr. Lauder gave me this data from his road); and you all know that the common way of supporting arch brick is on water tubes, that the water tube grate is not at all an uncommon thing in the East, and the length of time that the fireboxes last there is entirely different from what we have. Tubes on our road will only give us about 120,000 miles before they have to come out, that is to say, about a year's service at 10,000 miles a month. You can readily see that those conditions are entirely different from the conditions on a road where the tubes will last 10 and 11 years. So that I think that while the statement is acceptable that these engines are practicable and serviceable on lines like the Reading and Lehigh Valley roads, where there is an abundance of cheap fuel, and where good water is available, that it is quite consistent to find out in the West, where there is not the same abundance of cheap slack coal and where water is exceedingly bad, that a different type of engine has to be used.

A few years ago the Union Pacific built a number of Wootten firebox engines, perhaps twenty. A couple of years ago, when I was going over the U. P. shops, I found that they were getting rid of those engines just as fast as they conveniently could. They found the boxes very expensive to maintain; and I presume they could not at all times get enough slack to run them, and when they were obliged to use lump coal the result from steaming was not satisfactory. So at the present time I think it doubtful if any of those engines are in successful operation on the Union Pacific. It will remain to be seen whether the modification as gotten up by Mr. William Forsyth will prove more satisfactory.

MR. J. N. BARR (C., M. & St. P.): There seems to be a sentiment that we have not got enough grate surface, but there seems to be quite a sentiment that we have got plenty of staybolts in our boilers. I suppose that both sentiments are right; but the tendency to-day to get entirely away from staybolts is, in my mind, rather questionable. In fact, I think it is going to be a case of "out of the frying-pan into the fire." We see all the troubles in the staybolts; they have been impressed on us by years of experience. Possibly in a year, in the ordinary types of boilers, there will be 15 or 20 staybolts to be renewed. Sometimes that number is exceeded with the steel staybolts, but with good iron staybolts, I presume, that we have renewed 15 or 20 a year Now, that has been impressed on us for a long time; we have talked over it and the methods of avoiding that trouble, and I think it has got to be a good deal like the oil question. There was a little story recently in one of our local papers to the effect that when a fireman applies for the position of engineer the examination at Milwaukee hinges on the matter of oil consumption; and the story goes on to say that one of the men, when asked what he would do in case of a collision, answered that he would shut off the lubricator, pick up the oil can and jump! I must say that if we devoted as much attention to saving fuel as we do to saving oil we would save dollars where we save cents; and further, that this matter of staybolt breakage, while it is troublesome and expensive, is not very serious, and we have manufactured a sentiment and made it one of the big bugaboos of railroading. Some of our friends, I have no doubt, will have a boiler some of these days that will not have any staybolts in, and I should not be surprised, too, if they would find out that when they have it they will be out of the frying pan into the fire with a vengeance—that they will be in a hotter place than they left by a great deal.

Now, with reference to the amount of grate surface: I have heard statements here and seen statements in the papers that a consumption of 200 lbs. to the foot is too much. I infer from what is said that it is too much for economy, and that 125 lbs. is about right. Now, I do not know on what basis those statements are made, whether it has been determined experimentally that burning 125 lbs. or 100 lbs. to the square foot per hour will evaporate more water per pound of fuel than by burning 200 lbs. Whether these extraordinarily large grates can be fired and handled by the average fireman as well as the smaller is a very grave question in my mind, and if they cannot it don't matter, theoretically or experimentally, how much more economical that boiler is. The whole thing gets to be quite a complicated question, and the more I think of it the more I think that I do not know anything about it.

MR. W. H. LEWIS (C., B. & N.): Now, I believe that our late experience has demonstrated that there is a great deal more economy in high pressures that we are carrying at the present time than in anything else that we have sought to accomplish in locomotive construction. We cannot find any man who is ready to come forward and say that an excessively wide firebox is an advantage, but we do know that an excessively narrow one is a disadvantage where the character of the road is such that you can load your engines down to their maximum efficiency and you find that to do this work you are burning out a firebox inside of two years (as is our experience). We must assume that the grate surface is too small and the rate of combustion is too rapid and that it is necessary to get it a little larger. Now, how large shall we go? I am not willing to believe that it is necessary to go to the extent that some have advocated. I really think that when you get 45 sq. ft. of grate surface you have gone to the other extreme as compared with the 18 5 ft. that we now have, and there is a loss by the fact that it is impossible to distribute the coal over those large grates to get the best results for combustion of the coal.

Prof. W. F. M. GOSS: I have read Mr. Bell's paper with interest and think it a most excellent one. It is a concise statement concerning the history of wide fireboxes, but it presents no arguments, or data, favoring their use. The discussion also indicates that the available facts are not sufficient to show how wide or how large the firebox should be.

I think, as has been stated by Mr. Forsyth, that we must decide how much fuel must be burned to do the work required, and then either assume a rate of combustion or find a rate experimentally by working with different grate areas while keeping the output of steam up to that which the boiler will be called upon to supply when in service.

I notice that the paper gives a description of two boilers on new engines, the performance of which should give considerable information as to the value of a large firebox. This C., B. & Q. boiler has about 35 sq. ft. of heating surface to every square foot of grate surface, while the C. & N. W. boiler has 71 ft. of heating surface for each foot of grate surface. Now, it does not seem possible that two boilers having a ratio of heating surface to grate surface of 35 and 71 respectively, designed for use in the same part of the country, can be equally efficient. If they are not equally efficient, which is to be preferred?

J. SNOWDEN BELL: In presenting the subject of wide fireboxes, it was my object, more particularly, to bring to the attention of our members the advantages of this type, as demonstrated in an extended period of service, and in over 1,100 locomotives, with anthracite fuel, believing, as I do, that advantages, similar in kind if not in degree, would be attained with the bituminous coal used in the West.

I am decidedly in favor of the wide firebox, but am not committed to any fixed width, nor to any special construction. It would seem that, for bituminous coal, it might be much narrower and shorter than the standard Wootten or the present wide fireboxes without combustion chambers, and while I am not prepared to fully agree with Mr. Gibbs that the firebox of the C., B. & Q. engine No 590 is "the best that has been brought out up to date," for Western coal, I believe that it is properly designed, has all the elements of success, and will so demonstrate in service. Mr. Barr's objection to *large* grates, on the ground that the average fireman cannot fire them properly, is, I think, applicable only to *long* grates, and this is the radical vice of the narrow firebox. In order to get enough grate area they must be made too long for *any* man, either the regular fireman or a new one, to handle.

I may add that the Wootten boilers referred to by Mr. Rhodes and Mr. Johann were of antiquated type and imperfect design, and that the failure of those on the Union Pacific has been probably due to very bad water and want of applicability to the special kind of fuel employed.

DAVID L. BARNES: In the East the tendency is decidedly toward larger grates for all engines, no matter what the fuel. In no other country on the earth is so small grate used for the same locomotive power as in this country. As will be seen from the discussion, the coal used per square foot of grate per hour often reaches 200 lbs. In Europe it seldom exceeds 50 to 75 lbs. This accounts mainly for the difference in economy of European and American locomotives.

To say to-day that a small grate is as good as a large one is to take a position directly contrary to the facts. No steam engineer in any sort of steam plant work would make grates any smaller than is absolutely necessary, unless by doing so the area of the grate is increased to a point where the coal burnt per square foot per hour is less than 20 or 25 lbs. The single exception to this is in the case of locomotives, where the demand for power varies considerably. If the grates are made too large there is a loss in descending grades and stopping at stations. For this reason grates on locomotives are made smaller than for any other class of steam service. The experiments made on ocean steamers show so conclusively that a high rate of combustion is accompanied by loss in efficiency that it does not seem that any one conversant with the facts could dispute the value of a large grate.

It is not to be expected that any railroad company will pay two firemen on a locomotive; and any design of grate that calls for additional help or for unusual exertion on the part of the firemen will not be successful, nor will it be more economical than a small grate that can be properly handled and easily fired by one man. I do not wish to be understood as saying that there are not in some cases good and sufficient reasons for the selection of a small grate area for a locomotive. Good reasons may be found in the conditions which prevail on some roads. But what I wish to emphasize is that, where the fuel used per square foot of grate per hour is more than 150 lbs., the use of a larger grate will give a substantial saving; particularly is this true with a comparatively poor quality of fuel such as is used on Western lines. In discussing a matter of this kind it is perhaps better to draw a sharp line between the efficiency *per se* of the locomotive, and those practical conditions which may force the selection of a grate area different from that which will give the maximum efficiency.

The question of staybolts for large fireboxes is discussed by Mr. Barr in a manner that is gratifying. It is a pleasure to hear an experienced railroad man say that "This matter of stay-bolt breakage, while it is troublesome and expensive, is not very serious, and we have manufactured a sentiment and made it one of the big bugaboos of railroading." This statement by Mr. Barr, coupled with another statement which he makes, that only 15 or 20 staybolts are renewed per boiler per year on his road, shows that he must have taken up the staybolt question in his usual thorough manner, and evolved a plan for making and putting them in which is an improvement on the common plan. Probably he uses good material, and cuts the thread with dies that are in proper shape, and puts the staybolts in with a small wrench and with only a reasonably tight fit in the sheet. There is nothing that will lead to so many broken staybolts as dull dies and tight fits.

A 24-ft. Plate-Steel Fly-Wheel.

Through the courtesy of Mr. Edwin Reynolds, Superintendent of the Edward P. Allis Company, of Milwaukee, we are enabled to illustrate a 24-ft. plate-steel fly-wheel which has been built by that company for a 32-in. and 62-in. × 60-in., cross-compound engine, directly connected to a general electric generator, for the West End Street Railway Company of Boston, Mass.

This is a departure from the ordinary fly-wheel construction which consists in casting the wheels in segments and bolting these together. In this wheel there are no internal strains to weaken it such as might occur in cast wheels. This in connection with other features of construction will permit greater velocity of rim then in wheels built up of cast segments and spokes bolted together. The speed at which this wheel is intended to run is 75 revolutions a minute, giving a speed at the circumference of 90 ft. a second or a little over a mile a minute. The weight is distributed as follows:

Center	33,000 pounds.
Web plates	47,700 "
Rim	69,300 "
Total	150,000 "

Fig. 1 is a side elevation of half the wheel and a longitudinal section through half the hub, while Fig. 2 is a transverse section of half the wheel. The hub is made of cast-iron, and is 8 ft. extreme diameter. Surrounding

this hub are two plates, *A*, Fig. 2, which are split on the diameter as shown by Fig. 1. These plates are of steel 1 in. in thickness and 23 in. wide. From these plates extend the web plates, 16 in number, to the extreme outside diameter of the wheel. These plates, *D*, Fig. 2, are also 1 in. in thickness and are faced along the edges so as to form a good joint. Between those on the opposite sides of the hub are 1 in. by 8-in. truss pieces *C*, Fig. 2, bolted at the ends with two ⅞-in. bolts, and having at the center two 1¾-in. bolts to act as struts. These bolts are turned down to 1⅛ in. on the ends. These truss pieces are put at the joints between the web plates. Outside of the web plates are two cover plates, *D*, Fig. 2, 1 in. in thickness and 27⅛ in. wide, which are also split on the diameter as plates marked *A*. Through the outside cover plates *D*, web plates *B*, and inside plates *A*, are 40, 2¾-in. bolts spaced so that three of them will come on each segmental web plate. Besides these bolts there are 48, 1⅛-in. bolts on each side through the cover and web plates. The section of the rim between the web plates consists of, 13 1-in. steel plates placed side by side and joining on the ends as shown on Fig. 1. The joints of these plates overlap as shown by Fig. 1, each plate covering seven joints of the others. Outside of the web plates on each side the rim are 1-in. × 12-in. plates forming a cover around the entire rim, this cover is made up of eight pieces. Still outside of this is another strip 1 in. × 5 in. also extending all the way round the wheel. 1¾-in. rivets hold the plates and the rim together. They are countersunk as shown in Fig. 2.

By this construction the increased strain on the rim between spokes is avoided, the web plates forming so to speak an infinite number of spokes. Other details and dimensions are completely given in the accompanying drawings.

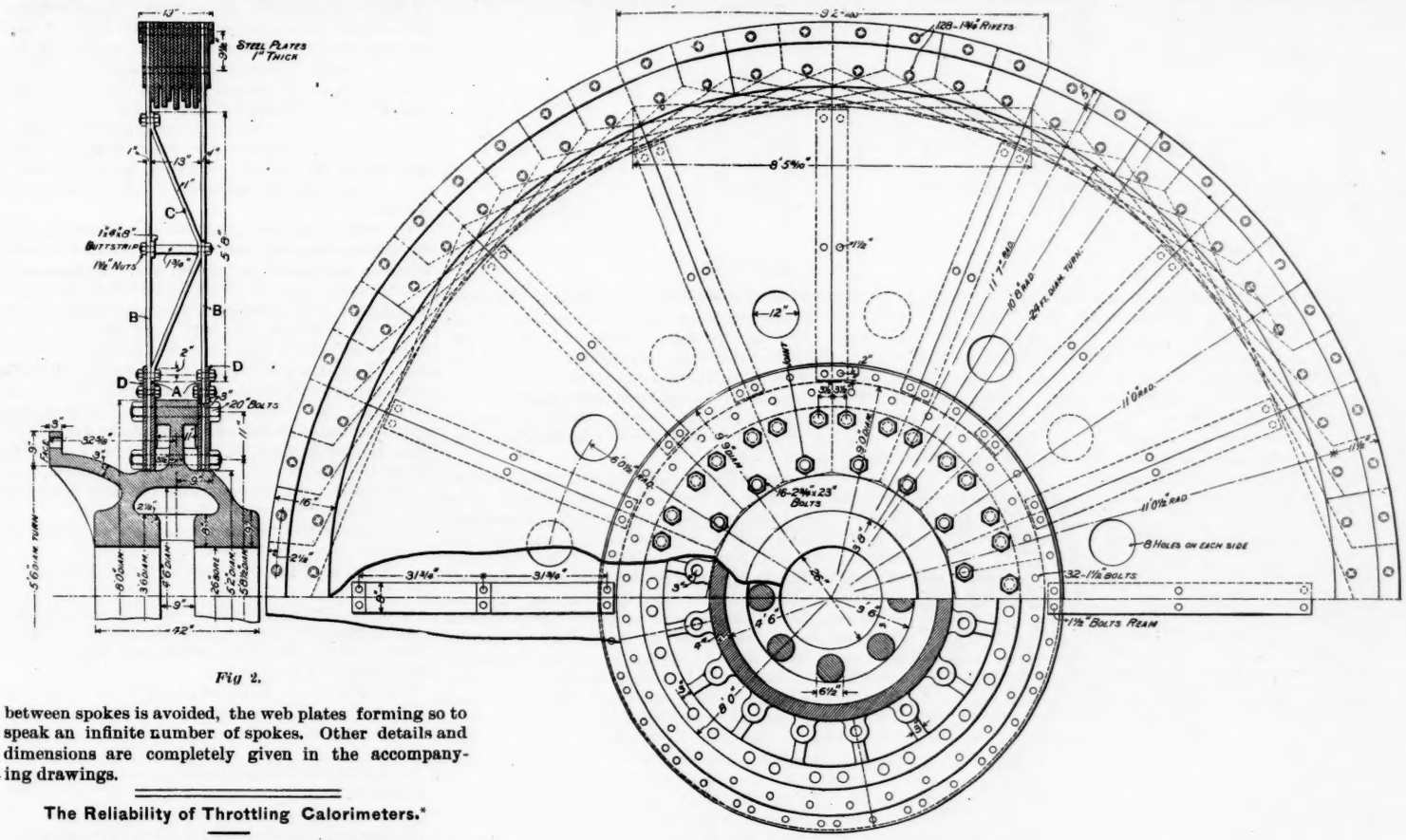


Fig 2.

A 24-FT. PLATE STEEL FLY-WHEEL.

Made by the E. P. ALLIS COMPANY, *Milwaukee, Wis.*

The Reliability of Throttling Calorimeters.*

BY PROF. JAMES E. DENTON, STEVENS INSTITUTE.

The object of this paper is to present the complete results of an investigation of this subject, undertaken at the request of a leading firm of builders of boilers (Babcock & Wilcox Co.) to determine:

1st. Whether it is, or is not, a fact that the proportion of moisture in steam as determined by the accepted methods of using a "throttling calorimeter" may be considerably in excess of the true proportion of such moisture.

2d. The conditions under which "throttling calorimeters" should be used, or the precautions necessary in using them, in order to insure practically accurate conclusions regarding the proportion of moisture in the steam under examination.

The investigation has divided itself into the following parts:

I.—The entire output of steam from a 75 H. P. boiler was made to contain known amounts of moisture while flowing through a 3-in. pipe, the determination of the true percentage of moisture being made to depend entirely on actual weighings of the steam and water involved.

The outlet from the 3-in. pipe was connected with a 75-H. P. separator, and with a large throttling chamber, so that the principle of the small "throttling calorimeters with separator attached," could be applied to the *entire* amount of steam mixture flowing through the pipe. Thereby it was determined that the *principle* of the "throttling calorimeter" was entirely reliable as a means of determining the percentage of moisture of any mixture which *passed through it.*

II.—Small "throttling calorimeters" were applied to the 3-in. pipe, with the ordinary arrangement of perforated nipple, and it was found that the percentage of moisture shown by them varied considerably from the true percentage, when the conditions were such as to make it probable that the moisture was separated from the steam or was not distributed throughout the latter when it collided with the nipple of the calorimeter. For instance, when the true moisture was 21 per cent. and 17.6 per cent., respectively, the small calorimeter showed 54.6 per cent. and 50.8 per cent.

III.—Small calorimeters were applied to the 3-in. pipe at the exit from the 75-H. P. separator, with the drip-pipe to the separator closed, under conditions which fairly insured the thorough distribution of the moisture throughout the current of steam when the latter collided with the calorimeter nipple, and it was found that, while the percentage of moisture shown by them was still liable to exceed the true percentage, the discrepancy was much less than when the conditions were such as to favor the accumulation of the moisture at some part of the surface of the pipe. For instance, when the true moisture was 0.5 per cent., 0.8 per cent., 1 per cent., 1.6 per cent., 2.5 per cent. and 19.1 per cent., respectively, the calorimeter showed 1 per cent., 1.5 per cent., 2.2 per cent., 3.6 per cent., 5.5 per cent. and 31.8 per cent.

Conclusions from I., II. and III.

The results of I., II. and III. made it evident that, while the small "throttling calorimeter" might be relied upon to determine correctly the amount of moisture in the sample of steam and water which is drawn into the instrument from the larger volume of mixture in a steam main, the percentage of moisture in such a sample may largely exceed the percentage in the steam main, if the moisture in the latter separates itself from the steam so as to accumulate at the point of connection of the calorimeter. It became necessary, therefore, to determine whether, under the usual conditions of good boiler practice—that is, for conditions where the moisture does not exceed one and one-half per cent.—there can be such a separation of the moisture from the steam so as to cause the erratic indication of the calorimeter.

IV.—To investigate this question two sets of experiments were made, namely:

(*a*) Two small Barrus calorimeters were arranged with an open-ended nipple working through a stuffing box by means of a screw, so that the end of the nipple could be moved radially in a steam main. One calorimeter was attached to the 12-in. horizontal main of a 500-H. P. boiler, at its bottom, and the other at about 4 in. along the circumference away fom the bottom point. By one of the screws controlling the nipples, the inner open end of the latter could be located anywhere in the pipe, from flush with its inside surface to 7 in. beyond the latter. When the boiler was known, by means of the absence of drip from a separator, beyond the calorimeters, to be generating dry steam, the bottom calorimeter showed dry steam when the end of its nipple was more than 1¾ in. away from the side of the pipe, and from 35 per cent. to 47 per cent. of moisture when it was at less than this distance away; while the other calorimeter showed no moisture at all possible positions of its nipple. The actual weight of water which passed through the calorimeter when it indicated 47 per cent. of moisture, represented only about one-third per cent. of moisture in the output of the boiler. The results, therefore, confirmed the hypothesis that less than one-half per cent. of moisture in a steam main might separate itself from the steam, and accumulate at the bottom of a pipe in a stream which would impinge against a calorimeter nipple in its path so as to flow up the side and into the orifice of the latter, thereby causing the indications of the instrument to greatly exaggerate the true percentage of moisture in the main. Evidently, if this hypothesis were correct, the extent to which moisture could separate itself between the outlet for steam from a boiler to the point where a calorimeter was attached would depend upon the velocity in the steam main, the diameter of the latter, and the distance from the boiler outlet to the calorimeter. In other words, the moisture, in dropping out of the steam in a horizontal pipe, would probably roughly follow the law of a falling body, and to ascertain how far this was the case we undertook experiment

(*b*) The same apparatus was used as described above in connection with I., II. and III., except that the 75-H. P. separator was omitted, and the small "throttling calorimeter" was connected with an open nipple, whose inner end was flush with the inside of the 3-in. pipe. The moisture was created in the steam by circulating cold water through a pipe located within the 3-in. steam main. After passing the small calorimeter the steam was throttled in the drum *N*, and from the indications of the latter, and those of the small calorimeter, the per cent. of the total moisture in the 3-in. main was accurately determined. The amounts of moisture created in the 3-in. main were confined to from ⅛ to 10 per cent., and the velocity of flow was varied from 15 to 65 ft. per second by varying the rate of steam generated by the boiler from 20 to 90 H. P.

The results clearly indicate that, in traveling a little more than twice the distance in the 3-in. main—which would be necessary in order for a body to fall by gravity through the diameter of the pipe—*practically all* of the moisture in the steam main would escape through the calorimeter.

Conclusions.

These results afford, I think, a key for the explanation of the erratic indications of "throttling calorimeters" in practice, which all extensive users of them have met to a greater or less extent. Variations in the proportions and arrangement of nipples, in the rate of evaporation, relative location of calorimeter, and position of steam mains leading to the point of attachment of the latter, will give rise to an infinite variety of results in the degree of the error which may be involved in the use of the instrument.

All parts of surface of any form of nozzle inserted in the steam main will act as a collector for moisture, which will adhere to the metal so as to resist being detached by the comparatively swift main current of steam, but which will allow itself to be gradually drawn into the nozzle by the gentler current of steam which flows into the calorimeter, because the latter has only to overcome the resistance to sliding of the water along the metal.

Under this view there seems to be no possible method

* Presented at the New York meeting (December, 1895) of the American Society of Mechanical Engineers.

of depending solely upon small "throttling calorimeters" to determine with certainty the percentage of moisture in a steam main. By using several instruments simultaneously, with the orifices of the nipples located at different parts of the cross-section of the main, or by making the nipple of a single instrument movable so as to explore the interior of the pipe—an approximately correct judgment may be made regarding the average moisture, which will be sufficiently complete for commercial purposes.

By combining a single calorimeter with a separator acting on the whole current in the steam main, however, the source of error in the calorimeter may be so far eliminated as to make its indications reliable. This method is based upon the fact that, by using a separator of sufficiently large proportions to confine the velocity of flow within certain limits, the moisture in the steam leaving the separator can be reduced from any probable amount to a small fraction of one per cent. For example, in the case of the 3-in. Stratton separator, if the velocity of flow is not more than 1,000 ft. per minute, with 27 per cent. of moisture in the steam entering the separator, there is practically no moisture in the steam which leaves it. If, therefore, a small "throttling calorimeter" be applied to the steam main at the exit from such a separator, the small amount of moisture there, and the fact that it will be thoroughly intermingled with the steam, make it reasonably certain that its indications will be correct for any arrangement of nipple, and, by combining these with the determinations of drip from the separator, the moisture in the steam generated by the boiler may be completely and reliably determined.

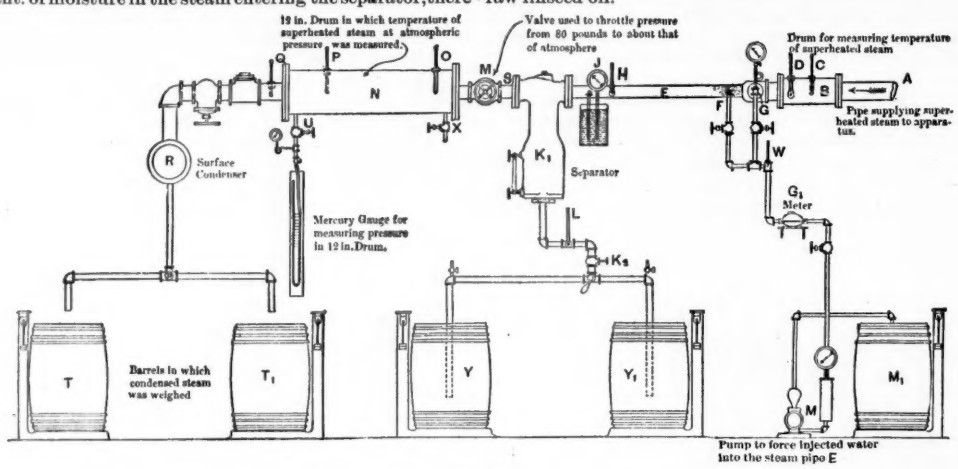


Fig. 1.

The principal arrangements for the investigation are shown by Fig 1. Steam was drawn from boilers by a 3-in. pipe *A*. The latter was enlarged to 6 in. at *B*, whereby the velocity of the flow of steam was made sufficiently low to enable its temperature to be accurately determined by means of the thermometers *C* and *D*. As the steam flowed past the points *G* and *F*, a stream of water was injected into it by means of the pump *W*, from a reservoir W_1, the rate of injection being regulated by means of the water meter G_1. When the water was injected at *G* it issued against the steam in an unbroken stream through small orifices; but when it was injected at *F* two streams of water, at an angle, were made to impinge against each other so as to spatter into a fine spray. The mixture of steam and water then passed a 3-in. Stratton separator *K*. The water was withdrawn from the latter by the valve K_2, whence it passed into the weighing barrels *Y*, and Y_1, the level in the water-glass K_1 being maintained at about one inch above its lower end.

The steam leaving the separator passed through the globe valve *M* into a drum *N*, 12 in. in diameter and about 5 ft. long, the valve *M* being regulated so that while at *J* the desired boiler pressure was maintained, the pressure in *N*, as shown by pressure gage *U*, would not be more than a fraction of a pound above that of the atmosphere. The temperature of the steam being given by the thermometers *O*, *P* and *Q*, this drum constituted a "throttling calorimeter" adapted to receive the whole amount of steam operated upon.

The small calorimeters to be tested were applied at *S* and *H*, the separating attachment and throttling device being both used for these two positions. The throttling device was also used alone at position *S*.

From *N* the steam flowed to a surface condenser *R*, in which it was condensed so as to be weighed in the barrels *T* and T_1.

All parts of the apparatus were well insulated with canvas-covered hair felt.

In experiments in which the moisture was thoroughly mixed with the steam, a Barrus "throttling calorimeter,"

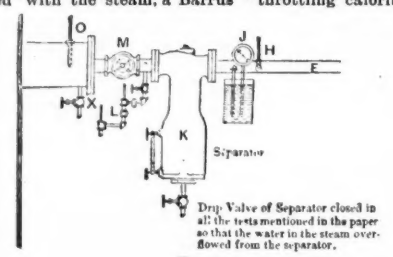


Fig. 2

L, without its separator, carefully calibrated for radiation, was attached (Fig. 2), beyond the Stratton separator. Superheated steam at *B* was mixed with water at *F*, and the mixture sent through the system to the condenser *without draining the Stratton separator*. After the flow through the system had continued a short time the level of the water in the water-glass of the separator remained unchanged. A constant mixture was, therefore, leaving the separator, and in issuing from the outlet of the latter into the three-inch pipe at *Z* there must have been a thorough intermingling of the water and steam.

The Painting of Iron Work—Comments.

BY A CIVIL ENGINEER.

(*Concluded from page* 782.)

At first sight there seems little in the foregoing mass of contradictions that can be grasped, correlated and pronounced as settled, beyond the universal admission that almost if not the most important condition is a surface free from scale or rust; but a careful analysis will prove that there are other points so bolstered by the weight of evidence that taken together they will provide a paint which may be safely used, with confidence in its protecting and lasting qualities. It is this analysis that I now propose to make.

The principal question to be answered before a correct decision can be reached is, what is paint, that is (a) what does it do and (b) what are the physical relations that should exist between its parts? The first is easily answered: Paint forms a skin over the surface which it is proposed to protect; a skin that is hard, elastic, adherent, impervious to moisture or the ordinary substances found in the atmosphere and that has no chemical affinity for iron.

In answering the second question we are met by two irreconcilable opinions both with regard to the character of the pigment and also as to the vehicle. Anhydrous oxide of iron *versus* red lead; boiled linseed oil *versus* raw linseed oil.

Of the two I shall first discuss the pigment. The question of first cost seems in the matter of painting to be of the least importance and the reasons for it are conclusive; the cost of labor as compared with that of material on first painting a bridge or roof is as two to one. If the painting must be repeated every three or four years, with a costly item of cleaning added on each occasion, the original expense due to materials is enormously overshadowed.

As between red lead and iron oxide, individual opinions are about equally divided. The most serious faults found with red lead, are, that it is difficult to spread and that it forms a soap in combination with the oil, which sets rapidly and behaves somewhat like hydraulic cement, the utility of which is destroyed if it is not used almost immediately after mixing. No one, it would seem, can deny that red lead, properly used, makes an excellent and strong pigment; but it must be used intelligently, and often by unintelligent men, under adverse circumstances. The buckets must be frequently filled from a freshly mixed supply and the paint must be applied with extreme care by persons of some experience, owing to the difficulty of spreading the paint and making it reach the least accessible corners of a truss.

Pure anhydrous oxide of iron is inert towards the oil and towards the iron itself. Its function as a pigment is to fill the minute pores which exist in the skin of oil after it has dried, and in this way, according to Messrs. Dudley and Pease it renders the oil proof against the attacks of moisture. Iron oxide is easy to apply, spreads readily and from the fact that no immediate chemical change takes place in the mixture, the paint may be compounded in large quantities, accurately proportioned as to its parts after having been properly tested for its quality under the eye of some responsible person. It is stated by Mr. Sabin that iron oxides must be sold at a low price, and are therefore prepared from soft and friable ores which are permeated with particles of the hydrated oxide which it is almost impossible to abstract. But is it impossible to secure a pure pigment at a price which will not be prohibitory? Probably not. Let it once be known what is wanted and the results will be secured. As the matter stands, paint is largely bought on its price, covering power and color, in fact, under the conditions which are of relatively small importance, and in a manner which would be considered entirely improper if applied to almost any other material; for no guarantee is asked and no inspection is made. The charge of adulteration has been made about equally against red lead and iron oxide; but almost anything, from the clothes we wear to the food we eat is adulterated, and will continue to be under the pressure of competition and the sad fact that the purchasers usually don't know and have no means of finding out what really is the best. In the case of paints, however, we are better off, since competition of the ordinary sort may be ignored, and there must be simple tests already known for roughly determining as to the quality of pigments. In any event the two materials stand upon an even footing here.

So far as "covering power" is concerned (and by this I mean the number of square feet which a given quantity of paint will cover when applied in the usual way) it is not a matter of much importance since in the light of present knowledge, the amount of protection afforded by a good paint is nearly proportional to the thickness of the skin that it forms.

The testimony of all, points to a mixture of nearly equal weights of oil and pigments; perhaps a little less than this of pigment, say 45 per cent. would improve the results since Dudley and Pease state that 40 per cent. of pigment with 60 per cent. of oil proved the most satisfactory in their test to determine the resistance of the paint to water.

In deciding the merits between boiled and raw linseed oil I am impressed with the force of the charge that oil is most frequently "boiled through the bung-hole" and it is apparently from this cause that the prejudice against so called boiled oil has arisen. That natural linseed oil contains particles of matter which readily absorb air and water and considerably interfere with the utility of the oil as a paint has not been denied. It therefore follows that a means of eliminating this substance, which does not otherwise injure the oil is desirable and this means is at hand. Why the oil should not be treated by blowing it with air at a temperature of 350 deg. or 400 deg. has not been explained. This it seems certain should be done, and, as has been suggested to me by a person of great experince, a filtering process in addition. After this if the oil is allowed to settle for a month and is then drawn off by a syphon, a pure and reliable article is certain. at an increased cost to be sure but as compared with the benefits to be secured, a sum of no importance whatever. It is perhaps equally certain that the term "boiled oil" should not be applied to the product resulting from this process.

I doubt the utility of a dryer. It introduces an unnecessary complication; it is not claimed that it increases the life of the paint and the conditions do not demand (under ordinary circumstances as with shop painting) that the period between the coats shall be reduced. If it appears for any reason that a dryer is necessary, that form which is compounded of lead and manganese oxides dissolved in pure turpentine (not benzine or any product of petroleum) is the proper form and in quantities not exceeding 1 part of the dryer to 19 of the oil.

The treatment of the metal before it leaves the works is an absolute necessity, but whether it should be with oil alone or with paint is less certain. My opinion, however, is vastly in favor of the paint, for if the oil forms a sufficient covering why add the pigment at all, and if it is not sufficient why not have the first coat (the most important) a reliable one? In addition it seems most likely that it would be difficult under certain circumstances to determine whether or not the metal had been oiled. As to the convenience or inconvenience of painting iron work before shipment, the necessity for it once admitted, the only remaining problem is one of detail and that must be solved by individuals.

I conclude with a summary of the facts as I see them.

1. A surface free from scale or rust.
2. A heavy coat before shipment; even before manufacture if it appears necessary.
3. A pigment of anhydrous oxide of iron ground in oil.
4. A vehicle of linseed oil which has been blown with air at a temperature not exceeding 400 deg. Fahr., next filtered, then allowed to settle, and finally has been drawn off with a syphon.
5. If absolutely necessary, a dryer composed of the oxides of lead and manganese dissolved in turpentine in amount not exceeding 5 per cent. of the amount of vehicle.
6. A mixture of 45 per cent. of pigment to 55 per cent. of vehicle.
7. A careful inspection of all materials.
8. The performance of all work by day labor and not by contract.
9. Painting should not be attempted in wet or freezing weather.

Fast Run from Jersey City to Philadelphia.

The officers of the Pennsylvania Railroad have made up a careful statement of a fast run made over the New York Division of that road on Sept. 18, 1895. This was an experimental run with locomotive No. 1,651, referred to in the report as class "L," a modification of the class "P" of 1895, as described in the *Railroad Gazette* of Feb. 22 last.

The revised class "P" weighs 127,050 lbs., with 87,300 lbs. on the drivers. The class "L" weighs 134,800 lbs. with 91,600 lbs. on drivers. It has 1,895 sq. ft. of heating surface and 33 sq. ft. of grate area. The cylinders are 18½ in. in diameter, with a stroke of 26 in., 2 in. longer than the stroke of the engine shown in our description. The test is notable chiefly by reason of the great weight of the train, which was composed of empty cars. The engine was supplied with best hand-picked Highland coal (anthracite). The seven cars made up practically the same kind of train as that which now runs as the Pennsylvania Limited, the total weight of the seven being 663,827 lbs. The observation car weighed 75,700 lbs. and the heaviest sleeper, the Paraguay, weighed 115,200 lbs. The engine and tender weighed 204,800 lbs., making the total weight of the train 434.31 tons. The weather was fair, temperature 66 degs. Fahr., rail dry; wind northwest, four miles an hour. The general direction traveled by the train was southwest. The train started at 1:14:50 p. m. and arrived at Broad street, Philadelphia, 89.6 miles, at 2:54:35, making the time 99¾ minutes and the average speed 53.88 miles an hour.

The grade of this road is easy. The principal ascents, with the number of the mile post at which they begin are as follows: m. p. 20, about 27 ft. per mile for four miles; m. p. 30, about 30 ft. per mile for three miles: m. p. 80, about 30 ft. per mile for two miles. The speed was maintained very evenly except where it was necessary to slacken for junctions, water troughs, etc. About 60 miles an hour was made all the way, up hill and down, except as hindered by the obstacles mentioned. At Newark drawbridge the speed dropped to 30 miles an hour; at New Brunswick to 40; at Monmouth Junction from 62 to 50. The fastest time from tower to tower was made near Deans, near Trenton and near N X tower, the speed being 59.76 m. p. h., 68.22 and 59.00 respectively. The fastest mile was made in 52 seconds, equal to 69.23 miles an hour: this was from m. p. 52 to m. p. 53, east of Trenton. The grade of this mile is level for a short distance, then descending for half a mile at about 18 ft. per mile, then level, then ascending at 10 ft. per mile.

The average steam pressure carried by the engine was 175.4 lbs., all of the observations after the start showing within about 3 lbs. of the average. The injector was used 72 minutes and 25 seconds.

On Oct. 24 a second experiment was made with a train weighing 57 tons less, but the water scoop, when running through the track tank at Monmouth, at 52 miles an hour, failed to take up any water, and the engine was not worked to its full capacity all of the way; but from Princeton Junction to Mantua, 40 8 miles, this train made 62.24 miles an hour as against 60.48 miles an hour on the run of Sept. 18. On the later run the steam was shut off on the Lawrence grade, and also while running through Trenton.

Performance of Compound Locomotives.

We give herewith a table showing comparative performance of a number of compound and simple engines, extending over periods running up to as much as two years and aggregating a great many miles. In freight service the engine miles of the compounds are nearly 118,000; the ton miles amount to a good many millions. The coal consumed is over 11½ million lbs. The savings shown are: Coal, 27 28 per cent. per ton-mile, and water, 25.14 per cent. In passenger service the total engine miles are 2,946, and the coal consumed 180,000 lbs. The saving in coal per ton mile is 23.59 per cent., and of water 28.8 per cent. There are two or three important facts to remember in examining the tables. One is that engine No. 2427, which made the comparative running in passenger service, is essentially a freight engine. Another is that none of the compound engines, except this one, were built compound; they were simple engines converted. Therefore it is not to be supposed that the highest efficiency was got out of them. It strikes us that these figures, covering so much time, so much service and such a variety of service, are uncommonly convincing.

Tests of a Cast Steel Bolster.

In the *Railroad Gazzete* of Jan. 25 and March 1, 1895, were given some results of tests of steel bolsters of the built up type and of cast steel, and we now add to those data the results of tests made more recently on solid cast steel bolsters. These tests were made by R. W. Hunt & Co. in Chicago. The bolster was supported at each end on wrought iron blocks, the center lines of which were 6 ft. 3 in. apart, which is the distance between the center lines of the arch bars of diamond trucks. The load was applied at the center.

Test No. 1.—Shickle, Harrison & Howard Steel Bolster Weight 63⅛ Pounds.

Load.	Deflection.
10,000	00 in.
20,000	.07 "
30,000	.12 "
40,000	.16 "
50,000	.21 "
60,000	.25 "
70,000	.30 "
80,000	.35 "
90,000	.42 "
100,000	.52 "
110,000	.62 "
120 000	.71 "
130,000	.86 "
140,000	1.16 "

142,900. Maximum load. Tension member (lower flange) cracked half way across at center of bolster; the fracture showed an old crack extending into the flange about 1¼ in.; fracture also showed shrinkage.

PERFORMANCE OF RICHMOND COMPOUND LOCOMOTIVES, COMPILED FROM OFFICIAL RECORDS FURNISHED BY THE RAILROAD COMPANIES.

Description of Engines.

Compound.						Simple.				
Road.	Engine.	Diameter H. P. cylinder.	Diameter L. P. cylinder.	Stroke.	Wheels.	Road.	Engine.	Diameter of cylinders.	Stroke.	Wheels.
Chesapeake & Ohio	140	19"	29"	24"	57"	Chesapeake & Ohio	Class "F 10."	19"	24"	57"
Cleveland, Cincinnati, Chicago & St. Louis	472	19"	30"	24"	56"	Cleveland, Cincinnati, Chicago & St. Louis	Class "Z."	19"	24"	56"
Cleveland, Cincinnati, Chicago & St. Louis	429	20"	32"	24"	56"	Pennsylvania Rai road	279	19"	24"	62"
Engine No. 2,427	2,427	19"	30"	24"	62"	Chicago, Milwaukee & St. Paul				
						Chicago, Rock Island & Pacific	808	19"	24"	63¾"
						Chesapeake & Ohio	126 and 127	20"	24"	62"

Compound—In Freight Service.

Name of Road.	Length of test.	Engine.	Length of run.	Time on run.	Miles per hour.	Engine miles.	Cars in train.	Car mileage.	Weight of train, tons.	Ton miles.	Pounds of coal consumed.	Pounds of water evaporated.	Engine, miles per ton coal.	Pounds Coal. Per 100 ton mile.	Per engine mile.	Per car mile.	Pounds Water. Per 100 ton mile.	Per engine mile.	Per car mile.
Chesapeake & Ohio	2 years.	140				85,236	38.7	2,891,793			8,524,000		20.00		100	2.95			
Cleveland, Cincinnati, Chicago & St. Louis	9 months.	472				18,978	24.7	468,150			1,924,000		22.02		90.8	3.70			
Cleveland, Cincinnati, Chicago & St. Louis	1 month.	472 and 429				6,379	25.4	162,027			474,000		26.79		74.3	2.93			
Pennsylvania Railroad, Middle Division, slow freight, East	6 trips.	2427	1 6.9	7:14	16.14	701.4	63.7	44,692	2,346.8	1,646,067	67,860	476,557	20.67	4.12	96.75	1.52	28.95	679.44	10.66
Pennsylvania Railroad, Middle Division, slow freight, West	6 trips.	2427	115.7	6:45	17.16	694.2	85.7	59,472	967.4	671 576	85,110	552,993	16.31	12.67	122.60	1.40	82.37	796.60	9.30
Pennsylvania Railroad, Middle Division, fast freight, East	7 trips.	2427	127.5	4:34	27.95	852.8	26.3	23,486	801.8	711,840	56,455	368,264	31.63	7.89	63.23	2.40	51.49	412.50	15.71
Pennsylvania Railroad, Middle Division, fast freight, West	7 trips.	2427	126.7	5:18	23.91	886.9	33.7	29,851	865.9	767,976	75,767	507,759	23.41	9.87	85.42	2.54	65.34	572.45	16.93
Chicago, Milwaukee & St. Paul	10 days.	2427				2,222			838.2	1,862.400	214,362		20.73	11.51	96.47				
Chicago, Rock Island & Pacific	12 trips.	2427	163	7:05	23.02	1,955			1,151.2	2,250,548	198,930		19.67	8.99	101.70				
Total freight service					21.64	117,945.3	42.6		1,161.9		11,620,984		22.36	9.17	97.36	2.49	57.04	615.25	13.15
In favor of compound					4.64%		10.94%		14.3%				20.02%	27.28%	19.55%	25.23%	25.14%	13.65%	18.32%

Compound—In Passenger Service.

Chesapeake & Ohio	21 trips.	2427	96.3	3:31	27.36	2,022	5.67	11,460	202.0	408,272	123,175	970,008	32.83	30.17	60.92	10.72	213.08	479.73	84.64
Chicago, Rock Island & Pacific	4 trips.	2427	181	6:20	28.58	724	12.00	8,688	338.3	244.952	56.930		25.42	22.75	78.63	6.55			
Total passenger service					27.97	2,746	8.84	20,148	270.2	653,225	180.105		29.12	26.46	69.77	8.63	213.08	479 73	84.64
In favor of compound													25.36%	23.59%	19.0 %	24.17%	28.85%	16.84%	18.91%

Simple—In Freight Service.

Chesapeake & Ohio	2 years.	10 Class "F 10."				700,664	37.5	23,502,808			91,860,000		15.25		131	3.91			
Cleveland, Cincinnati, Chicago & St. Louis	9 months.	12 Class "Z."				279,927	24.3	6,476,906			31,594.000		17.72		112.8	4.80			
Cleveland, Cincinnati, Chicago & St. Louis	1 month.	12 Class "Z."				41,586	23.1	960,637			3,795,000		21.91		91.2	3 96			
Pennsylvania Railroad, Middle Division, slow freight, East	5 trips.	P. R. R., No. 279.	117	7:55	14.81	584.9	53	31,005	2,015	1,178,585	84,995	482,224	13.76	7.24	145 31	2 75	40.91	827.73	15.55
Pennsylvania Railroad, Middle Division, slow freight, West	5 trips.	"	115.7	7:03	16.52	578.5	71.4	41,305	793	458,836	99,625	556,604	11.61	21.71	172.21	2.41	121.30	962.15	13.47
Pennsylvania Railroad, Middle Division, fast freight, East	8 trips.	"	127.3	4:33	28.19	1,018.4	26.6	27,062	793.3	807,897	68,504	447,031	29.73	8.48	67.27	2.53	55.33	438.80	16.52
Pennsylvania Railroad, Middle Division, fast freight, West	8 trips.	"	126.5	5:35	22.67	1,012	33	33,383	712.4	720,969	98,016	628,773	20.67	13.60	96.86	2.94	87.26	621.31	18.84
Chicago, Milwaukee & St. Paul	10 days.	{13 C., M. & St. P. Simples.}				36,625			752.4	27,761,400	3,831,701		19 12	13.80	104.62				
Chicago, Rock Island & Pacific	12 trips.	Rock Island, No. 808	165	7:47	21.20	1,980			1,033	2,045,216	221,650		17 87	10.81	111.94				
Total freight service		Total			20.68	1,063,975.8	38.4		1,016.5		131,653,400		18.63	12.61	114.80	3.33	76.20	712.50	16.10

Simple—In Passenger Service.

Chesapeake & Ohio	27 trips.	C. & O., 126 and 127.	96.3	3:27	28.14	2,600	5.37	13,963	187	486,589	220,117	1,457,392	23.64	45.23	84 66	15.76	299.50	560.53	104.38
Chicago, Rock Island & Pacific	4 trips.	Rock Island, No. 808	181.0	6:27	28 06	724	12.83	9,050	365	264,404	63,430		22 83	24.03	87 61	7.01			
Total passenger service					28.10	3,324	9.10	23,013	276	750,993	283,547		23.23	34 63	86.13	11.38	299.50	560 53	104.38
In favor of simple engine					0.46%		2 91%		2.15%										

NOTE.—All of the above engines are of the ten-wheel type. Chesapeake & Ohio No. 140 is a converted engine of their class "F 10," and is exactly like the engines running against it, all being built at the same time.
Cleveland, Cincinnati, Chicago & St. Louis No. 472 is a converted engine of "Big Four" class "Z" and is exactly like the engines running against it, all being of the same age. Cleveland, Cincinnati, Chicago & St. Louis No. 429 is also a converted class "Z" engine, but was not changed to compound until two years old.

American Armor Plate Abroad.

Press reports say that the Bethlehem Iron Company has received news from Russia stating that a very succesful test of their armor had been made at the proving grounds, near St. Petersburg. "The test," which was a severe one, "passes 550 tons of Harveyized side armor plate for the Russian battleship Sevastopol."

On December 15, 1894, the Bethlehem Iron Company was awarded the contract for supplying the side armor for Russia's two new battleships, the Petropaviosk and Sevastopol. The side armor for the Savastopol was finished only recently and a plate chosen from the group of 550 tons was shipped to Russia for the above test.

It is reported that the Carnegie Steel Company, in addition to its Russian armor plate contract, has made a small trial order of plate for the Japanese Government.

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

The new crop of Nicaragua Canal bills has already begun to appear. Dec. 3 Congressman Mahon introduced into the House of Representatives a bill to amend the act of incorporation of the Maritime Canal Company. Mr. Mahon proposes that the capital stock shall be $83,000,000; that $70,000,000 of this stock shall be subscribed to by the Secretary of the Treasury in behalf of the United States and deposited in the Treasury, in consideration of the guarantee of the United States of the bonds. The United States Government is to guarantee the principal and interest of $70,000,000 of bonds, interest at 3 per cent. Ten millions of the capital stock is to be delivered to such persons as may be designated by the stockholders of the company whose stock has been surrendered and canceled, and stock of the company to an amount not exceeding $4,500,000 shall be issued for the reimbursement of all necessary and proper expenditures made by the company since June 3, 1889. This latter shall be full satisfaction of all claims against the United States or the Maritime Canal Company. The bill provides for the eventual ownership by the nation of this property, in that the United States reserves the right to purchase the stock at any time at a sum which shall not exceed the par value of the stock, with 3 per cent. per annum from the date of its issue to the opening of the canal to commerce. It is further provided also that the Government can foreclose under the mortgage, but not until the expiration of five years after the canal shall be in operation, provided the canal is actually being operated during those years. The provision is made, however, that in case of default in interest on the bonds before the canal goes into operation the United States can foreclose immediately, without the necessity of judicial proceedings; which, it will be seen, is a very handy arrangement under which the Government can take up the uncompleted work and go on and finish it. It is wisely provided also that no dividend may be paid exceeding 5 per cent. per annum, but that the balance of net earnings shall be paid into the United States Treasury as a sinking fund for the retirement of the bonds. Moreover, all dividends on the stock owned by the United States shall go into this same sinking fund. Thus, considering the probable net earnings, the bonds will be rapidly canceled—at least Senator Morgan would tell us so. The bill provides that the canal shall be constructed under the supervision, plans and specifications of the Engineer Bureau of the United States Army, and that the President shall detail three officers of the Corps of Engineers who shall enter regularly the service of the Maritime Canal Company, one of whom shall be the Chief Engineer of the canal. The Canal Company will, however, pay into the Treasury every year an amount equal to the salaries of these officers. We trust that they will not waive their right to receive their salaries from the Government in the usual way and under the usual conditions. Mr. Mahon's bland disregard of the estimates of the Engineer Commission, which have just been published, is almost pathetic. It is impossible to imagine how he expects to get Congressmen to vote for a guarantee of $70,000,000 on a canal which, according to the best disinterested expert report we have had, will cost at least $133,000,000.

A few months ago the railroads entering Zanesville, after a season of lively competition for the large brick traffic of that city, concluded to form a little pool and apportion the business among them at a living rate. But just as they had the proportions and everything nicely arranged, one of the shippers went to the Common Pleas Court and secured an injunction restraining the lines from putting into operation the proposed pool. Some railroad people are now wondering what the effect would be if the American Sugar Refining Company, of New York, or some big shipper that is supposed to be getting concessions in rates, were to go to the New York courts and apply for an injunction restraining the Joint Traffic Association from putting its ponderous organization into effect. These railroad people are also wondering what the probability is that an attempt of this kind will be made by a disgruntled shipper.—*Cleveland Paper.*

Possibly the marked difference between the "Joint Traffic" agreement and an agreement to pool brick shipments might affect this reasoning. It is well enough to "wonder" what would be the effect of an injunction, but a more pertinent question for the alleged "railroad people" to speculate upon would be: Where can the big shipper find the judge who will issue such an injunction? Pooling contracts are likely to be frowned upon or condemned by the courts, because of the general opinion that pooling is contrary to public policy; but the "ponderous organization" referred to is not a pooling contract. A judge who reads the agreement with a view to enjoining the roads not to put it into operation will have difficulty in finding the mare's nests which so many newspaper writers think they see in it. The essential wickedness, if there be any, is in the agreement to let nine men make rates, and the virtual promise of each company to accept the judgment of the nine and use those rates. But making rates according to the judgment of a Board—representing himself and all his competitors—instead of acting wholly by himself, is just what every traffic manager has been doing for the last 15 or 20 years. It is true that managers have thus made rates by agreement, and have then gone home and made secret discounts to favored shippers, but how does that affect the standing of the tariffs before the law? The principal difference between this agreement and former agreements is that now, it is hoped, the man who breaks agreements will stay his hand. If, when he goes home (after agreeing to a certain rate), he finds his assistant in tears because "the other road" has already broken the agreement, he will not at once telegraph cut rates to a dozen big shippers in the hope of making it appear that he, instead of the other road, was the first to show his affection for the dear public by breaking his pledge to his competitors; he will restrain himself awhile and see if the joint board will not redress his grievance. Whether this self-restraint will be strong enough and last long enough to produce a real improvement is the main point which now excites curiosity. The most definite ground for hope is to be found in the fact that each road has promised to make all its acts in this connection a matter of record; to change rates only by resolution of its board of directors. Heretofore rate cutting has often been saved from discovery by shifting the responsibility from one officer to another.

Low Passenger Fares in a Thinly-Settled Country.

Mr. D. H. Ainsworth, M. Am. Soc. C. E., writing from San Francisco, says:

The distance from Seattle, Wash., to Portland, Or., by the Northern Pacific Railroad is 186 miles, and the fare is $7, or about 3.76 cents a mile. By the same road the distance from Seattle to Tacoma is about 40 miles, for which the fare is 50 cents, or 1¼ cents a mile. The distance from Seattle to Olympia by the same railroad is 75 miles, and the fare charged is $2, or 2⅔ cents a mile. By water the distance from Seattle to Tacoma is 28 miles, for which 25 cents is charged, or less than 1 cent a mile. By water the distance from Seattle to Olympia is 60 miles, for which $1 fare is charged, or 1⅔ cents a mile. It would seem that railroad fares have some reference to steamboat fares though not strictly to be compared with them or with each other. They are not uniform certainly, and hardly conform to the Interstate Commerce law. Has the Federal Commission ever given permission to consider the water of Puget's Sound a competitor of railroads? Or have receivers, who appear to get salaries in proportion to the poverty of the road they represent, made a tariff only to secure those salaries? Perhaps the *Railroad Gazette* may reconcile the prices charged, or may know what defense the railroad in question may set up?

From Seattle southward to Tacoma the railroad finds it so hard to get passengers that it has to reduce rates to a low figure; to Olympia, farther south, the competition of other carriers seems to be less keen, and the road apparently has concluded that it is getting its fair share of the passengers without making such an extreme reduction; while to Portland, still farther south, the traffic manger evidently feels satisfied that he is getting all the passengers that wish to go, or that would go at any reasonable price, and so he has made a high rate. Our correspondent evidently desires to find out if this high rate is "reasonable and just."

We do not know what "defense the railroad may set up," and as we have not the statistics of this line separate from the other traffic of the Northern Pacific, we cannot "reconcile" the different rates with precision; but it is easy to imagine very good justification for the differences. The advertisement of the Union Pacific gives the local rate of that road in Oregon as four cents a mile. As the state railroad commissioners and legislatures out that way, in their efforts to secure greater benefits to the people, always go for reductions in freight rates, we assume that if either the freight or the passenger tariff is to be high, it had better be the latter. That the total income of the road is not outrageously high would seem to be indicated by the fact that the Northern Pacific (as well as the Union Pacific) is insolvent. To answer that the insolvency is due to bad management might account for a small part of the difficulty (though it would not cure it): and it may be that the traffic manager even now is standing in his own light—we do not know but he could stimulate travel and make more money by reducing the fare to Portland; but, broadly speaking, it is fair to assume that four cents a mile is not very exorbitant in a new, thinly settled country.

The people of Texas, who have done with the railroads whatsoever they saw fit, have not, we believe, had much fault to find with passenger fares, although rates are probably about the same there as in Washington. The Texas legislature and commissioners have devoted their attention to freight rates. In the last Interstate Commerce Report the average passenger rate in Group IX. (Texas and Louisiana) is higher than in Group X., which includes Washington, Oregon and California (year ending June 30, 1894; Group IX., 2.44 cents; Group X., 2.04 cents). The density of passenger traffic is greater in Group X., but it is to be noted that Group IX. has no large city like San Francisco to increase the average amount of business per mile of road. Certainly if the Northern Pacific collects a few thousand dollars more than the most rigid temporary economy would dictate, there must be ample opportunities to spend it for the benefit of the people of Washington. Citizens who think the public is not getting its full share of benefit from the railroad would probably do better to go for improvements in safety and conveniences than for a reduction of fares below four cents a mile.

Water competition has never been treated as different from railroad competition, we believe (in considering the rightfulness or legality of reducing rates to meet it), except in cases where the railroad company charges or desires to charge less from A to C (where water competition exists), than for the shorter distance from A to B, where it does not exist. To thus charge less for the longer haul violates the fourth section of the Interstate Commerce Law, unless the dissimilarity of circumstances is sufficient to justify the difference, and the cost of water transportation is so very much less than by rail that the difference does constitute a marked dissimilarity of circumstances. The Interstate Commerce law has to recognize this because its provisions do restrict the railroads but do not apply to the boats. This law, however, does not apply to traffic wholly within the State of Washington.

The Interstate Commerce Commission has never given any permission to the waters of Puget Sound as to how to conduct themselves. Probably those waters will compete with the railroads whenever they see fit, regardless of the acts or opinions of the Commission. They have a strong presumptive right to do so, as they were in business several hundred years before the railroads started. Whether the Interstate Commerce law does or does not apply, a railroad, to get passengers away from the boats, would have to make low rates. What difference does it make whether the competitor be a boat or a flying machine? A man has lately ridden a mile in 58 seconds on a bicycle, so perhaps, we shall have soon still another kind of long distance competition. (Bicycles already compete for short distances).

Who is injured by the low rates to Tacoma and Olympia? Certainly not the people who buy the tickets. The man who pays the high rate to Portland is not injured, but rather helped. If the Northern Pacific raised the Tacoma rate the people would go by the boat, and the railroad company would have less income than now; and then, to keep its trains running, it would have to charge the Portland passenger *more* instead of less. The railroad Receiver whom our correspondent supposes to be making rates chiefly for his own personal benefit would be the chief complainer, we should say.

As for the difference between the two water-regulated rates, we are too far away to judge. Unless the traffic to Tacoma is very heavy, we should say that the Olympia rate is the more reasonable. With traffic of ordinary density, 1¼ cents is too low, as compared with the

rates which the railroad has to charge for other service, and is only justified where it is impossible to get any more.

Annual Report.

New York & Brooklyn Bridge.—The annual report of the Trustees of the New York & Brooklyn Bridge for the year ending Dec. 1, 1895, has been issued within two or three days. The total receipts for that year amounted to $1,224,272, an increase of about $94,000 over the preceding year. This increase was divided between the railroad and the carriage ways. Receipts from the railroad amount to about 92 per cent. of the total. Receipts from other sources brought the aggregate up to nearly two millions. The expenditure on construction account was $247,000, on lighting cars by electricity $18,750, for two locomotives $10,404, new rails $20,791. The total expenditures for the year amounted to $1,647,317, leaving a balance on hand of $307,743.

The passengers carried on the railroad in 1895 were 44,564,3.9. The year before they were 41,714,235. For the ten years between the opening of the bridge and Aug. 1, 1893, the number of passengers carried steadily increased, but for the year from Aug. 1, 1893, to Aug. 1, 1894, the passengers carried were fewer than in the preceding year. Since then, however, the travel has increased; at first in just about the same ratio that former increases have gone on, and later in a much greater ratio. Taking the four years ending Nov. 30, 1895, the changes in passenger traffic by percentages have been: Increase, 5 per cent.; increase, 2 per cent.; decrease, 2.1 per cent.; increase, 6.8 per cent. The railroad has been in service about $12\frac{3}{16}$ years, and during this period more than 391 million passengers have been carried. The maximum number carried in any one year was in the year now reported on. If Brooklyn alone had furnished this number of passengers it would be equal to the passing over once in every nine days of its entire population. The maximum carried in one month was in October, 1892, 4,033,920. This month included the week of the Columbian Festival. The nearest approach to this was October, 1895, when 3,909,133 passengers were carried. During the past year the greatest number of passengers carried in one day, as indicated by the sale of tickets, was 107,310. The total amount of time lost from all causes during the year was 5 hours and 42 minutes.

The whole history of the bridge railroad up to the end of the year reported on shows that while over 390 million passengers have been carried, but two accidents have occured which resulted in severe or fatal injury to persons on the train, and each of these was during an unusually dense fog, when a moving train overtook and collided with a preceding train. The first of these accidents occurred Dec. 5, 1885, when a passenger was seriously injured. The second occurred Nov. 19, 1895, when one passenger and a trainman were fatally injured. Aug 4, 1894, a car was derailed and dropped to the roadway. Fortunately, no one was injured. It is an astonshing fact that this record is completely ignored in the daily newspaper discussions of the bridge management.

Up to the date of this report nine hauling cables have been in use, of which seven were worn out and removed. The greatest number of ton-miles hauled by any one of these cables amounted to nearly 36 millions. The trustees have arranged for the installation of an electric plant wherby one or more trains may be experimentally switched at the station, and the work on this is now in hand. Of course the purpose, primarily, of this installation is to try electric traction in a small way with a view to its ultimate adoption.

By the plans now adopted and being pushed to completion, the capacity of the railroad to transport passengers will be doubled, and when the stations are finished the means of ingress and egress will be greatly increased. The new stations will provide much larger platform space, more than double the aggregate stairway width and a much more direct line of movement for the passengers.

The fast run recently made by a 10-wheel passenger engine on the Lake Shore & Michigan Southern, has aroused widespread interest in the question of the most suitable design of locomotive for high speed, and discussion and speculation have to do not alone with the size of driving wheels, but also with the function of the forward truck. Some of those who have commented on the performance of the Lake Shore 10-wheeler have said that if the forward truck of the engine had only been 2-wheel instead of 4-wheel the triumph of the American locomotive builder would have been complete. The mogul locomotive—three pairs of drivers and a single pair of small wheels in front—has been often characterized as unfit for high speed, though the reasons for holding this view have not been very clearly explained. It is a fact, however, that mogul engines have already made very fast time on American railroads in numerous instances, and one of the most prominent examples is to be found on the Chicago, Burlington & Quincy, where engines of this type have been used on fast passenger trains for several years. The fast run from Galesburg to Aurora, recently reported in the newspapers, was made by one of these engines, No. 512, which was built by the Rogers Locomotive Works in 1892. We have not received the official report of this run, but the figures, as reported to us by a reliable authority, are substantially the same as those published. The train was an eastbound passenger of four cars, and the fast run was made on Nov. 10, when the train was an hour late. The run from Galesburg to Galva, 22½ miles, was made in 21 minutes. From Kewanee to Buda, 15 miles, the time was 13 minutes. In the next 33¼ miles the speed had to be slackened for the bridges at Bureau. A stop was made at Princeton and one at a railroad crossing, but the distance was traversed in 36 minutes. Making fair allowances for the five stops and the bridges, the rate of speed from Galesburg to Mendota was 80 miles an hour. From Neponset to Buda, 6 miles, the time was 4½ minutes. Last April this engine hauled the fast mail, six heavy cars, from Western avenue, Chicago, to Galesburg, miles, in 165 minutes, including two stops to transfer mail, of six minutes each, and one crossing stop. Speed had to be slackened three times. On this trip the train ran from Galva to Galesburg, 22½ miles, in 21¼ minutes. This engine has six driving wheels 5 ft. 8 in. in diameter and two Brunswick 37-in. steel-tired truck wheels with wrought iron centers. The boiler is of the Belpaire type and carries 180 lbs. steam presure per square inch. The engine has a single high exhaust pipe. Other dimensions and particulars are as follows:

ROGERS MOGUL, NO. 512; C., B. & Q. R. R.

Fuel	Bituminous coal.
Weight on drivers	101,000 lbs.
" " truck wheels	19,000 "
" total	120,000 "
Heating surface	1,692 sq. ft.
Grate area	31.5 "
Cylinders, diameter	19 in.
" stroke	24 "
Steam ports, length	17¼ "
" " width	1¼ "
Exhaust ports, length	17¼ "
" " width	3 "
Bridge, width	1¼ "
Valves, kind of	Allen-Robertson.
" greatest travel	5 in
" outside lap	7/8 "
" inside lap or clearance	0
" lead in full gear	1/16 "

At the last election in the State of New York the people voted (under the provisions of the new constitution) to spend $9,000,000 on canal improvements, and the State Engineer, Mr. C. W. Adams, was re-elected. He is now preparing to begin work at as many different points as possible, as soon as the funds for the work are available, which will be about Jan. 1. The law provides for bonds to the amount of $9,000,000 for improving the Erie, Champlain and Oswego canals. The work is described as follows:

"The said improvement to the Erie and Oswego canals shall consist of deepening the same to a depth of not less than nine feet of water, except over and across aqueducts, miter sills, culverts and other permanent structures, where the depth of water shall be at least eight feet, but the deepening may be performed by raising the banks wherever the same may be practicable; also the lengthening or improving of the locks which now remain to be lengthened, and providing the necessary machinery for drawing boats into the improved locks and for building vertical stone walls, where in the opinion of the State Engineer and Surveyor and Superintendent of Public Works it may be necessary. The improvement upon the Champlain Canal shall consist in deepening the said canal to seven feet of water, and the building of such vertical stone walls as in the opinion of the State Engineer and Surveyor and Superintendent of Public Works may be necessary. The work called for by this act shall be done in accordance with plans, specifications and estimates prepared and approved by the State Engineer and Surveyor."

In addition to this work, a novel plan is to be tried at Lockport, on the Erie Canal, between Rochester and Buffalo, to combine the five locks at present in use in one large steel lock, with a single lift. This lock, when it is to descend, will be moved by a surcharge of water sufficient to overcome its weight and friction and the counterweights, said surcharge to be decreased to a corresponding extent less than the counterweights when the lock is to rise. This surcharge, it is estimated, will not exceed 3 in. in depth. The locks would be under the control of air brakes and hydraulic buffers. The plans for this work are being made, and the departments are being organized for carrying out the whole scheme of improvement. A meeting was held in Albany on Dec. 4 to decide upon the best means for carrying on the work. State Engineer C W. Adams, his deputy, H. Roberts, and Superintendent George W. Aldridge, of the State Department of Public Works, were present, as well as a number of their assistants. The best method of awarding the contracts was discussed. It was decided to begin the surveys at once and to put a corps of engineers on each 15-mile stretch of the Erie Canal. To aid them in their work Superintendent Aldridge has decided to draw off the water in the canals before there is a chance of ice forming.

It is quite wonderful to think what chances the young men of this day have for education, and it is especially wonderful to see how the facilities for engineering education in all its branches have developed within a few years. This thought is suggested now by the receipt of a prospectus issued by the University of Minnesota of a course in locomotive engineering, to be given in the department of mechanical engineering in that University. The University has a college of engineering, metallurgy and the mechanic arts, in which are given courses in mechanical, civil, electrical, mining and metallurgical and chemical engineering, with their several subdivisions. In mechanical engineering the course is divided into shop practice, engineering, drawing, mechanics, theoretical and applied; machine design, mechanical laboratory, electrical theory and practice, steam generators, steam engines and other prime movers, locomotive engineering and car design It will be seen that if the scheme of this department is carried out with any thoroughness the young men of the Northwest can get all the knowledge, general and special, that they can digest. The special course in locomotive engineering is, we judge, quite new; at least, we have never before heard that such a course had been established there. It is under Assistant Professor H. Wade Hibbard, of whom our readers already know something He is a graduate of Brown University, spent three years in the Rhode Island Locomotive Works, then took a technical course at Cornell, then was three years at Altoona, during which time he spent a summer in Europe studying foreign locomotive engineering. He then acted for a while as chief draughtsman of the Lehigh Valley Railroad system. The course of lectures and instruction which has been laid out in this special department is ambitious. The lectures, from the synopsis which is before us, cover the locomotive with great thoroughness and minuteness. The drawing-room course and the mechanical laboratory work appear also to have been designed with sufficient care. A thorough programme of locomotive testing is arranged as a part of this course, but we are informed that the University is not yet equipped for this. It is expected, however, that arrangements will soon be made with one of the railroads of the vicinity for road testing. The drawing-room work and the lectures are given in the evening to allow men who are at work on the railroads to attend them, and we are told that both drawing-room work and lectures are being well attended by railroad men as well as regular University students. The only charge for the year is the registration fee of $5. Again we say that the youth of to-day are most fortunate.

A press dispatch from Port Townsend, Washington, says that a concession has been obtained from the Chinese Government by a syndicate of American capitalists to build a railroad from tidewater to Pekin, "about 200 miles," and that it will open up valuable coal mines. Names of some of the concessionaries are given. Mr. Basch, of Port Townsend, "is now on his way across the continent with two railroad engineers to sail for China to examine the route." We have no accurate information as to the truth or untruth of this report, but we venture to say that the facts are about as follows: A railroad will soon be built from Tien Tsin to Peking. That distance is not 200 miles, however, but less than 90, and perhaps as little as 75. The road will not be built under concession by a foreign syndicate. It will be built by a Chinese company, or possibly by the Chinese Government, and the money may be borrowed here or in Europe, most likely in Europe. We venture to make this correction of the press dispatch on general knowledge of the situation. The Chinese railroad system now ends at Tien Tsin, which is the head of deep water navigation on the Pei-Ho, and for years efforts have been made to continue it to Pekin, which efforts have been defeated by a hundred different circumstances, mostly by the opposition of the mandarin class. The events of the war may well have convinced the Imperial Government of the great importance of railroad communication with the capital. The existing railroad had its origin at the Kai Ping coal mines and was extended to Tien Tsin, in order to bring the coal down to the port. All the "opening up" that the new line would do would be to permit "all rail" coal to be carried to Pekin. It has long been a fixed policy of the Chinese not to allow the railroads to be built under concessions to foreigners, and it seems improbable that any change in this policy has now been made. Of course our diagnosis of the situation is subject to correction, but we imagine it to be a good deal more accurate than the dispatch from Port Townsend.

"The Fastest of Fast Runs" is the title of a pamphlet which has been issued by the Brooks Locomotive Works, containing the record of the fast run over the Lake Shore & Michigan Southern on Oct. 24 (which was printed on page 722 of the *Railroad Gazette*), together with perspective views of engines 564 and 599. It will be remembered that this train was drawn, throughout the entire trip, by Brooks locomotives, engines 597, 598 and 160, which drew the train over other divisions, being of the same class as No. 599 here described. As before noted, engine 564, which made the best divisional record, has driving wheels of moderate size. It appears from this circular that the actual measured diameter of these wheels at the time of the run was 66 in., which makes the average number of revolutions per minute 371. The circular gives the maximum speed of this engine on this run as 92.3 miles an hour, at which speed the number of revolutions per minute must have been 469. The maximum piston speed thus would be 1,878 ft. per minute and the average 1,484 ft. The Brooks people also issue a statement of the coal and water used by No. 564, made up from careful estimates prepared by Master Mechanic Elden, of the Lake Shore. This statement is as follows:

Coal used	3,250 lbs.
Coal used per mile	37.79 lbs.
Water evaporated	30,833 lbs.
Water evaporated per lb. of coal	9.48 lbs.

The amount of coal per train mile used by engine No. 999, hauling the Empire State Express, as averaged for a month by Mr. Buchanan in 1894, was 32.38 lbs., including that used in starting the fire. The average speed of the Empire State Express was 50.7 miles an hour. At 469 revolutions a minute, the rate which was made by engine No. 564 at her highest speed, she would have made, if she had had 72-in. wheels, over 100 miles an hour; with 78-in. wheels this number of revolutions would make 109 miles an hour; with 84-in. wheels 117 miles an hour and with 86-in. wheels 120 miles an hour. At these higher speeds the resistance to be overcome

would, of course, increase much more rapidly than the rate of speed, and this speculation is offered only for the purpose of showing what speed is possible, with sufficient boiler and firebox capacity, without exceeding the piston speed that was accomplished on the Lake Shore.

The auditors of the principal railroads in the Vanderbilt system, acting in conformity to an agreement heretofore made by the traffic managers, have voted to settle divisions of earnings on through freight way bills by correspondence between auditors, after the close of the month, instead of by junction settlements as is now the practice With junction settlements, each through way bill shows the proportion of earnings accruing to each road, and on a shipment delivered, for instance, by the Lake Shore to the New York Central at Buffalo the latter road pays in cash to the former the amount of charges accruing up to that point; and a similar process is repeated every time the shipment is delivered by one road to another. This involves much clerical labor at junction points, besides the unnecessary handling of money. With auditors' settlements, divisions need be calculated only once a month, and then for the totals between any two points. The disadvantage of auditors' settlements is in the long time required to make out and adjust the accounts; a railroad may not know its precise earnings on the joint traffic for a month or more after the end of the month in which the business is transacted. But it is expected that agreements between the roads for daily or weekly payments of lump sums, as approximate balances, will obviate most of the inconvenience or injustice incident to this condition. The Beech Creek road is said to be the only Vanderbilt road not joining in the new arrangement. The Star Union Line of the Pennsylvania system has long used auditors' settlements, and it is said that they have been in vogue west of Chicago for some time.

The eastbound "Overland Flyer" of the Union Pacific runs from San Francisco to Chicago in 84 hours, about 7¼ hours longer time than is taken by the westbound train. The eastbound arrives in Chicago at 7:45 a. m., and the first express train to New York after that hour leaves at 10:30. This train (over the Vanderbilt lines) reaches New York in 28¾ hours, making 112¾ hours through from San Francisco to New York. Adding the 2¾ hours wait in Chicago the total elapsed time, through, is 115½ hours; or 118½ hours apparent time, as against 100¼ hours apparent time on the westbound trip. The shortening of time from the old schedules had to be done mostly by the Union Pacific and the Northwestern. On the Southern Pacific, between Ogden and San Francisco, the present rate of speed of the westbound train, 26 miles an hour, is only one mile an hour faster than it was before the change, while the rate over the Union Pacific between Council Bluffs and Ogden, 33.9 miles an hour, is more than four miles an hour faster than before.

NEW PUBLICATIONS.

Rapid Transition Boston. The first Anual Report of the Boston Transit Commission, for the year ending Aug. 15, 1895.

The first Annual Report of the Boston Transit Commission is a valuable document to put in the library of the engineer who may have occasion to study similar works. It is embellished with maps and plans, with line drawings of the structures, and with a number of very well reproduced photographs of the work under way. Presumably, those readers of the *Railroad Gazette* who are interested in this work are already pretty familiar with the engineering features of the Boston subway. Therefore, we shall reproduce now nothing of what appears in this report, for we have already printed engravings and description of the engineering work.

The first part of the report is written by the Chairman of the Commission, Mr. George G. Crocker. To this is appended a special report by Mr. Howard A. Carson, the Chief Engineer, and the volume is finished with a number of appendices giving special information, some of it of value. For instance, there are statistics of travel by actual count, at various places in the city, and there is a table giving the canvas of bids for excavation, construction and erection of Section I. of the subway. This contract, it will be remembered, was awarded to Messrs. Jones & Meehan, of Jamaica Plain. Their total bid was $139,602. The highest bid was $231,625, by Messrs. Woodbury & Leighton, of Boston.

The Chairman gives the history of the Commission, reviews the chief remedies suggested for relief of the situation, and describes the subway plan. He says that the question was early discussed as to whether it was wise to arrange for a connection with the steam railroads, so that the cars of these roads could be passed directly through the city. In conferences with railroad officers the Commission received no encouragement sufficient to justify it in seeking definite power to construct a subway of dimensions sufficient for the use of steam railroads. The dimensions of the subway under construction are, however, great enough to admit such cars as the New York, New Haven & Hartford runs in its suburban traffic around New York City.

The total expenditure up to the date of the report was $917,255, of which $751,155 was for real eseate.

The report of the Chief Engineer describes in some detail the preliminary surveys and the studies for the structure, for stations, terminals, etc.

It appears that a definite plan for ventilating the sub way has been adopted. It is to be divided into sections of 600 ft., and each section is to have a fan of sufficient power when run at moderate speed to remove the total air contents of the section once in 10 minutes, or once in seven minutes when run at a maximum speed. The corresponding rates of flow of air currents within the subway will be 60 and 86 ft. a minute. The number of fans may reach 12, and the usual aggregate volume of air moved will exceed 12,000,000 cu. ft. an hour. It may be made to reach 18,000,000, a sufficient quantity to meet all demands. The fan for the two-track sections will be 7 ft. in diameter, that for the four track 8 ft. They will draw air from the tunnel and expel it through specially provided chambers and vent shafts placed at one side of the tunnel. The fans will be driven by electric motors, and each fan when run at average speed will consume about the same power as a single car in motion.

The Baltimore & Ohio Railroad.—The *Bond Record* (published by the Bond Record Publishing Co., 24 Nassau street, New York), contains in its December issue a long article on the Baltimore & Ohio Railroad system, written by Mr Ernest S. Cronise, M. Am. Soc. C. E. The article covers twenty-six pages and carries a large map of the system and competing systems, together with smaller maps of terminals. We do not mention it now with a view to making any review of the article or extracts from it, but simply to call attention to it as being an excellent and instructive piece of work.

The system is considered under the headings of history, location, physical characteristics, physical condition, terminals, traffic and finance. The historical review is brief, but sufficient for the purpose. The paragraph on location describes the geographical situation, with distances. Under physical characteristics the author considers especially the grades and their influence upon the operation of the road. He says it will perhaps cause surprise that the opinion is advanced that the Baltimore & Ohio should be able to handle a heavy traffic almost as economically as any other line in the United States. This opinion is based on the fact that the heavy grades are all bunched and unusually well adjusted to the movement over them, permitting pusher engines to be used to the greatest possible advantage. The very serious handicap of the excessive curvature of some portions of the line is not considered in this division of the subject, but is taken up as one of the elements affecting the traffic.

The discussion of the terminals, which fills four pages of the article, is especially valuable. We discover in this one instance in which the author has fallen into what seems to us a popular but serious error. He says that the delays to ferry transportation across the North River are oftentimes very great in foggy weather and when the river is blocked with ice, and the delays and even dangers incident to the longer sail between St. George and the Battery would be even more formidable. A very long and constant experience in the navigation of the North River has convinced us that fog and ice cause so little trouble that they may be almost ignored in considering this subject. It is true that they do sometimes cause serious delays, and when they do these delays make a great impression upon the minds of the people who cross; but taking the service year in and year out the trouble to passengers and the delays and risks to freight seem to us quite trivial as compared with the great advantages which the waterway offers in the way of cheap and convenient distribution along the immense water front of the harbor.

Under the divisions of traffic and finance a good many facts are conveniently grouped and analyzed and valuable tables are collected, showing income account and balance sheet for seven years

On the whole the study is not only very interesting, but it is really valuable, and it belongs to a class of studies of which we should like to see a great many more made. In fact, the *Bond Record* promises that a similar study of the Erie will soon follow.

American Steam and Hot-Water Heating Practice. Being a selected reprint of Descriptive Articles, Questions and Answers from the *Engineering Record.* 318 pages, 8 in. × 10½ in., with 585 illustrations; no index. New York: *Engineering Record*, 1895. Price $4.00.

The collection of reprinted articles from the pages of the *Engineering Record* is intended to supplement a book on steam-heating problems, published in 1888. It is a selection of descriptions of hot-water and steam heating and ventilating installations in different classes of buildings prepared. This part of the volume fills the first 238 pages; the remaining portion—namely, 80 pages—is made up of a collection of questions and answers on matters arising in this department of building engineering, which have already been published in the pages of the journal during the period since 1888.

The main portion of the work is a collection of illustrated articles, which cover residences and apartment houses, churches, schools, theaters, hospitals, railroad shops and public buildings, hotels, office buildings and miscellaneous installations. The portion devoted to railroad structures proper covers only about 14 pages. It includes a roundhouse and shop on the Chicago & Grand Trunk at Port Huron, a station for the Suburban Rapid Transit (elevated) Railroad of New York, the Thirty-first street plant of the Minneapolis Electric Street Railway Co., the Boston & Albany station at Springfield, Mass., and the steam heating plant of the Northern Pacific Railroad shops at Tacoma. The article last mentioned is the most important of this group. The shops employ about 500 men, and were built at a total cost of more than $1,000,000, from the designs of Mr. J. W. Kendrick, then Chief Engineer, now General Manager. The system adopted was a steam supply from a central battery of boilers through a principal delivery and return main to the branch mains of all the principal departments. The radiation is chiefly from wall and ceiling coils of 1-in. wrought iron pipe. The total contract price of this heating plant was about $26,000, exclusively boilers, and it was installed by W. F. Porter & Co., of Minneapolis, Minn. This installation is described in considerable detail with illustrations.

The various articles describing the installations in a great number of buildings cover, in many cases, plans for ventilating as well as for heating, and they are so profusely illustrated as to make them very valuable to engineers studying these questions. We have noted the fact that the book has no index. It has, however, a full table of contents, classified conveniently and designed to make reference easy.

Twenty sixth Annual Report of the State Board of Health of Massachusetts. For the year ending Sept. 30, 1894. Boston: Wright & Potter Printing Co., state printers, 1895.

The 26th annual report of the Massachusetts State Board of Health is an octavo volume of 1,039 pages, 32 of these pages being occupied by the alphabetical index. The value of this annual document to all those who have to do with water supply and with the great hygienic questions, is so well known that we need do no more than to call attention to the publication of this volume. The division of water supply and sewerage covers 700 pages, much the largest part of the report. An important subdivision is the very detailed statement of the results of examinations of water supplies. These examinations covered a great number and variety of sources, and the reports fill 333 pages. Another division of the report which will be of especial interest to the water works engineers is the discussion of the subject of the Metropolitan water supply for the Metropolitan District of Boston. Concerning this great project our readers have been informed in a general way in previous issues. Considerable valuable information as to rainfall and flow of streams is tabulated in one division of the report. Among special reports we may mention one on the composition of water in deep wells in Boston and vicinity by Dr. T. M. Drown; another on bacterial contents of certain ground waters and deep wells, by Dr. W. T. Sedgwick; another (and this is a long document covering over 250 pages) on purification of sewage and water at the Lawrence Experiment Station, by Mr. George W. Fuller, Biologist in Charge.

TRADE CATALOGUES.

Machine Tools. Hilles & Jones Company, Wilmington, Del.

Catalogue L, 1895, of the Hilles & Jones Company, is just received. It has illustrations of a special line of machine tools for working iron and steel plates, bars and structural shapes. The illustrations are from photographs and no description or price list is given. Some tools of great power and capacity are shown. These include multiple punches and gate shears, plate planing machines, beam coping machine, single and combined punches and shears, bending rolls, etc.

Steel Making in India.

The Engineer for Nov. 1 contains an analysis of the prospects of steel making in India, from which we may get some idea of the cost at which steel can be made in that country, and hence of the possibility of steel works there eventually taking an important part of the Indian, Chinese, Australian and African trade. The author speaks of the contraction of the radius of supply of the English steel works, and his figures indicate that the local production should easily undersell the imported—a fact which, if true, is of grave importance to both English and American steel makers. The possible development of the great Bengal and Salem ore fields by cheap native labor under European supervision gives a chance for the investment of idle English capital.

It does not seem possible to readily find a site for a proposed steel plant in India which shall combine the advantages of proximity to cheap raw material and labor, and facility for getting the manufactured product to consumers at a low cost. Such an ideal position, however, is rarely found; in fact, it is doubtful if any of the great English steel works are so situated. The author of *The Engineer's* article thinks that the neighborhood of Calcutta offers the most favorable site for such a plant. It is a large shipping port and a railroad center. It occupies an intermediate position in respect to the best raw material, and labor is cheap and abundant. Selecting Calcutta as the center of operations, Port Canning on the Mutlah River, a few miles from the capital, would seem to be the best location in that vicinity for the proposed plant.

The ore of the Salem district, about 240 miles southwest of Madras, has been found the best for steel-making, being a rich magnetite, with low phosphorus and sulphur, well suited for making acid steel. With cheap labor and royalties from the government, which is anxious to encourage local industries, the ore can be placed on broad cars of the railroad, which runs close to the ore fields, at about 87 cents a ton. The freight rate per mile should be about that at which coal is carried in Bengal, or about $1.50 per ton for the distance of 240 miles and the cost of putting it on shipboard in Madras Harbor. From Madras to Calcutta is 1,090 miles by water, and the author assumes a charge of $1.39 per ton

delivered, the return vessels carrying coal for the Madras Railway, which would, of course, benefit largely by the ore traffic. The total cost of assembling the ore for each ton of pig is, therefore: Freight, $2.89; value of ore, 87 cents; quantity per ton of pig, 36 cwt.; total cost, $6.75. At Middlesbrough this becomes $6.50. At Pittsburgh the author estimates the freight as $2.62; value of ore, $1.87; quantity per ton of pig, 38 cwt.; total cost, $8.50.

Next considering the question of coke. An analysis shows Indian coal, unwashed, to contain 40 per cent. volatile matter and about 48 per cent. carbon. Durham coal, 26 per cent. volatile, 66 per cent. carbon. Connellsville coal, 30 per cent volatile, 58 per cent. carbon. The comparative cost of mining per ton is, about: India, 87 cents; England, $1.16; United States, $1.06. The author therefore estimates the value of coke produced from the above coal, including cost of labor, etc., as: India, $2.08; England, $2.45; United States, $2.25. To these figures we must add in each case the freight on the amount required per ton of pig, which gives: India, $3.79; England, $3.45; United States, $3.75. The author in obtaining these figures allows for the difference in quality of the coke and the consequent difference in amount required per ton of pig.

The remaining consideration is limestone. The most available supply is that on the Island of Bamri, 400 miles from Calcutta by sea. The cost of this stone cannot be estimated at less than $1.25 per ton, with say 7 cwt. necessary for each ton of pig. Taking these figures into account, the author concludes that the cost of steel in the three countries per ton should be as follows: India, $11; England, $10.12; United States, $12.49. In the case of India he then adds $1 for mean labor, sundry materials, stores, taxes, etc., and for England, $1 18. This brings the final cost for these two countries as, India, $12; England, $11.31. Considering the cost of sending English-made steel to India it would seem from these figures that a local product could be successfully and extensively manufactured. As for converting the product into rails and manufactured shapes of all sorts, this could be accomplished by native labor under competent European supervision for less than two-thirds of the cost in Europe.

There is in Calcutta at the Government ordnance factory a Siemens-Martin furnace, which has produced with perfect success castings and ingots for the past four years, using native labor, and there will shortly be erected at the same place a bar mill capable of producing light rails, etc. The author closes his analysis with a suggestion of the market existing in India for manufactured steel, such as rails, etc. He also hints at the possibility of the markets of China, Africa, Australia, etc., being supplied from such a plant as the one under consideration.

The New Engineering Laboratory at Purdue University.

The dedication ceremonies of the new engineering laboratory of Purdue University, Lafayette, Ind., were held Wednesday, Dec. 4. This building replaces the old laboratory which was destroyed by fire on the night of Jan. 23, 1894. A floor plan of the new laboratory as it now stands is shown in the engraving. The outlines of the old building have been preserved in the new one, but an addition has been made of a separate building for the locomotive testing plant which was originally situated in the main building. The portion of the building burned included everything but the foundry, coat room and wood room on the left. The fire started in the boiler room and stopped at the wall between the engineering laboratory proper and the wood room.

The floor plan shows the location of the equipment of the new laboratory which has been improved with the rebuilding. The space originally occupied by the locomotive testing plant now contains the Buckeye, Straight Line, Baldwin and Atlas engines. The total horse power of the engines now in the laboratory is over 1,500.

Elastic Packing for Journal Boxes.

The Elastic Packing Manufacturing Co., of Jersey City, is making an elastic waste for packing journal boxes, which has shown such good results on 18 railroads in the United States, that some words concerning its composition and manufacture will be of interest to railroad men. The waste is a combination of an absorbent packing, such as wool, and a resilient, which latter serves to make the waste springy, to prevent it from sagging and becoming matted when saturated with oil, and to keep it pressed up against the journal. The resilient used is cocoanut fiber, which is imported especially for making this packing. It is first steamed and cleaned, and is then put through steam rollers to straighten it, after which it is dried over steam drums and allowed to curl up naturally. In this state it is free from dirt and impurities of any sort, including certain acids, to remove which this process of cleaning has been adopted.

The woolen waste for mixing with this fiber is thoroughly cleaned by means of blowers, and is then spread on the factory floor, being covered with the fiber in such amount as will make a packing of the required proportions. The quantities of fiber and wool vary somewhat according to the particular amounts specified by the consumer, some roads finding better results in their service with a less amount of wool than others. This layer of fiber is then covered over again with another layer of wool, and so on. The material is then carded together, the resulting product being the elastic waste or packing.

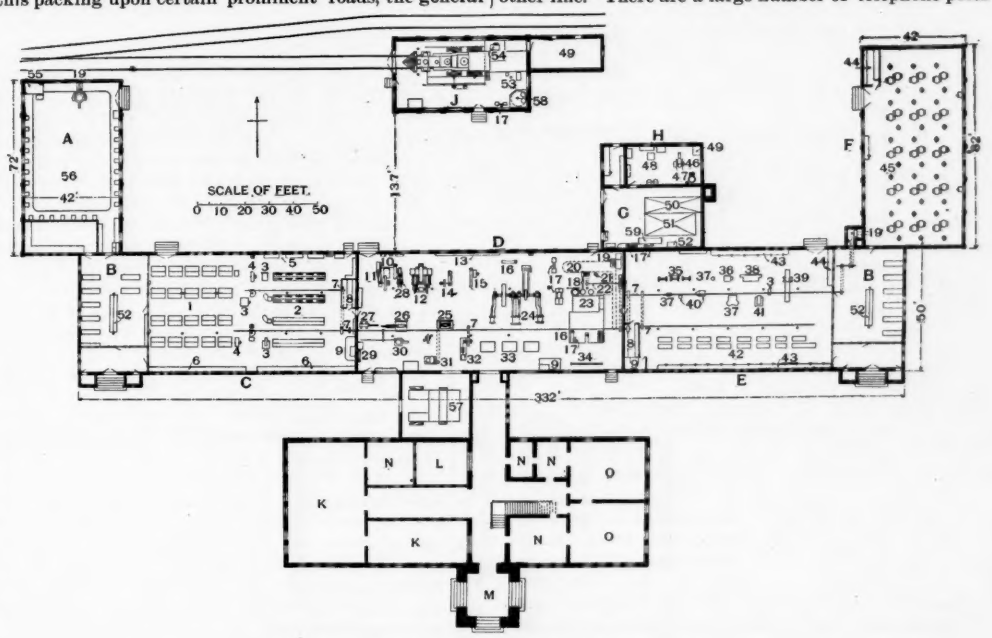
Owing to the quantity of non-absorbent fiber in this waste it will soak up, and therefore use, less oil than ordinary wool waste. It does not glaze from contact with the journals, and does not require the addition of more waste after a short run, which insures more perfect lubrication than would otherwise be obtained. Further, the lightness of the fiber and its action in distending the wool mixed with it makes the packing very light, and three-fourths of a pound of elastic waste will pack a box which would require 1¼ lbs. of wool. In using it one pound of elastic waste is used to two gallons of oil, it requiring three-fourths of a pound of dry elastic waste to pack a standard M. C. B. box.

Some comparisons between this packing and ordinary wool waste are given below. The elastic packing was first used with grease, and, as will be seen, not quite half a pound was used with somewhat over 8 lbs. of grease for packing the box. Using ordinary wool a little more than twice as much in weight of waste was used and somewhat more grease, which showed a saving in waste of 50 7 per cent by weight, and in weight of grease of 4.4 per cent. in favor of the elastic packing. Comparing the two wastes, using oil, about the same results followed, the saving in waste being 52.2 per cent., and the saving in oil 4.1 per cent.

COMPARISON OF WOOL AND ELASTIC PACKING.

Box packed with waste and grease.		*Box packed with waste and oil.*	
Elastic packing, per box	4862 lbs.	Elastic packing, per box	.6747 lbs.
Grease, per box	8.01 8 "	Oil, per box	7.5128 "
Total	8.5 "	Total	8.1875 "
Wool, per box	.9872 "	Wool, per box	1.4125 "
Grease, per box	8.3878 "	Oil, per box	7.8372 "
Total	9.375 "	Total	9.25 "
Saving in w. t. of waste, 50.7 per cent.		Saving in waste, 52.2 per cent.	
Saving in w. t. of grease, 4 4 per cent.		Saving in oil, 4.1 per cent.	

We have received very favorable reports of the use of this packing upon certain prominent roads, the general verdict being that a material reduction in the number of hot boxes, and more perfect lubrication have resulted. One road shows large economies over cheaper forms of waste—using it on their freight equipment. Another road writes: "We find that the elastic waste does not settle sway from the journal, or roll up to one side, as is the case with woolen or cotton waste, hence journals are better lubricated. We also find that the elastic waste lasts longer." The theory of its composition is undoubtedly a correct one.



Mechanical Laboratories at Purdue University.

A, Foundry; *B*, *B*, Coat Room, Lockers; *C*, Wood Room; *D*, Engineering Laboratory; *E*, Machine Room; *F*, Forge Room; *G*, Boiler Room; *H*, Gas Room; *J*, Locomotive Laboratory; *K*, *K*, Drawing Room; *L*, Instrument Room; *M*, Tower; *N*, *N*, *N*, *N*, Office; *O*, *O*, Class Room.
1, 40 Benches; 2, 40 Lathes; 3, Saw; 4, Stone; 5, 2 Lathes; 6, Bench; 7, Clutch; 8, Tool Room; 9, Office; 10, Air Compressors; 11, Buckeye Engine; 12, Baldwin Engine; 13, Gage Testing; 14, 7 × 10 Atlas Engine; 15, Laval Steam Turbine; 16, Condenser; 17, Pump; 18, Leffel Water Turbine; 19, Blower; 20, Low Level Tank; 21, Pelton Wheel; 22, Dynamometer shaft; 23, Weir Tank; 24, Triple Expansion Corliss Engine; 25, Westinghouse Engine; 26, 300,000-lb. Testing Machine; 27, Hydraulic Testing Machine; 28, Straight Line Engine; 29, Cement Testing; 30, 100,000-lb. Testing Machine; 31, Dynamo; 32, 10 × 16 Atlas Engine; 33, Tables; 34, Locomotive Link Model; 35, Speed Lathes; 36, Milling Machine; 37, Grinder; 38, Grinding Lathe; 39, Planer; 40, Drill; 41, Shaper; 42, 16 Lathes; 43, Vise Benches; 44, Stock; 45, 30 Forges, Blast Underground, Exhaust Overhead; 46, Otto Gas Engine; 47, Kimball Engine; 48, Car Lighting Plants; 49, Coal; 50, Babcock & Wilcox Boiler; 51, Atlas Boiler; 52, Sink; 53, Dynamometer; 54, Scales; 55, Core Ovens; 56, Molding Floor, 24 Benches; 57, Heating Plant; 58, Tanks; 59, Water Heater.

The Chicago City Railroads in a Snowstorm.

The elevated roads of Chicago had varied experiences in the severe storm of snow and sleet on Nov. 25. The movement of electric and horse street cars was practically stopped. The Metropolitan elevated road, had no stops of moment and carried an unusual number of passengers. The other elevated roads were in bad condition and did not begin running on regular schedule until late in the day. The fall of snow was six inches and was accompanied by rain and sleet. This, of course, make it much harder to clear the tracks than if there had been snow alone. The worst delays were not caused by the blockade of the tracks by snow, but by the fall of telephone and telegraph wires and poles caused by the accumulation of ice and snow on the wires.

The surface lines suffered most. The Chicago City Railway Company's tracks were kept in working order by running the cable continuously all night and operating track sweepers. This was done with the Wabash Avenue and State Street lines. The cross-town electric roads, operated by the same company also kept track sweepers in use throughout the night. The most serious trouble was a blockade of the trolley lines on Thirty-ninth, Root, Forty-third and Forty-seventh streets. This was caused by the fall of six poles of the Chicago Telephone Company on Root street between Halsted and Wright streets. The current had to be cut off from these lines on account of their breakage by the fall of the telegraph poles and the crossing of the various wires with the trolley conductors.

On the north and west side cable lines there was considerable trouble owing to slowness in getting out the snow plows and sweepers, and people dependent on these lines for reaching the business center of the city were much delayed.

The Metropolitan Elevated suffered no delay except a slight one about 3 a. m., caused by wires falling across the structure. The fallen wires were speedily removed and a force of men patrolling the tracks kept them clear thereafter. The third rail system stood the test well, especially as the traffic was the heaviest this road has yet had, owing to the fact that a great number of people who were unable to get down town on the surface roads, took the elevated. There were no telegraph poles near enough to this road to obstruct the tracks by their fall, the only danger being from a few over-hanging wires.

The Alley Elevated also was not delayed except occasionally from one to two minutes, owing to the increased traffic. Some of the telegraph poles near the structure on the southern end of the line were inclined towards the tracks by the weight of the snow and ice, but not enough to interfere. They were propped up and no breakages occurred. The Rowel-Potter block signals were rendered inoperative by the ice.

The Lake Street Elevated suffered more than any other line. There are a large number of telephone poles standing close to the structure, and it was from the fall ing of these across the tracks that the delays occurred. At 11:40 p. m. the first pole broke and fell across the tracks, 500 ft. west of Oakley avenue. This blocked the westbound track. From that time on through the night the poles kept breaking, and 23 in all fell on the structure. They were cut away from the wires and thrown off the tracks as fast as the men could do it. There were no accidents to trains. By 6:40 a. m. the tracks were clear to Rockwell street, and at 7:15 the trains were running to Sacramento avenue. It was 2:30 in the afternoon before the train schedule over the entire road was resumed.

American Society of Mechanical Engineers.

The first session of the sixteenth annual convention of the American Society of Mechanical Engineers was held Tuesday evening, Dec. 10. Tellers were appointed and topical discussions were held. The most important of these was on the best method for the extraction of oil from condensed steam.

The majority of those who took part in the discussion advocated some sort of filtering material, such as coke, sponge or straw, through which to force the water. All

these materials are used, either separately or together. Mr. John C. Kafer, Superintendent of the Morgan Works, said that engines could get along without cylinder oil. He said that some of the big steamships use no oil in their cylinders. An engine is practically "lubricated" by the steam. The surface became glass-like in smoothness and extremely hard.

J. F. Holloway, an ex-President of the society, said that he knew of engines that used no cylinder oil. He said that much depended on how an engine was treated in the beginning. If you fed it oil then it would squeal for it if you ceased feeding it.

James G. Winship said that long ago his father, who was engineer at the Allaire Works, had run an engine for many years without a lubricant for the cylinders. When the engine was taken apart after long service the surfaces were found to be flawlessly smooth. Discussion on this subject was continued on Thursday morning.

On Wednesday morning, the Secretary read the annual report of the Council. This included, besides general business, the reports of the Finance Committee and Library Association and the notices of the deaths of E. F. C. Davis, formerly President of the Society, and Eckley B. Coxe.

The officers elected were announced as follows: President, John Fritz, Bethlehem, Pa.; Vice-Presidents, Geo. W. Melville, Washington, D. C; Chas. H. Manning, Manchester, N. H.; Francis W Dean, Boston, Mass.; Treasurer, William H. Wiley, New York; Managers, Norman C. Stiles, Middletown, Conn.; E. D. Meier, St. Louis, Mo.; and Geo. W. Dickie, San Francisco, Cal.

M. G. C. Henning, of the Committee on Standard Methods of Testing Materials, read a report on the International Convention of Engineers and Manufacturers held at Zurich, Switzerland, last September.

The committee for considering the question of revising the Society's Code of Steam Boiler Trials reported progress.

Mr. H. de B. Parson made a report for the Committee on Fire Proof Tests, to determine the effect of fire on modern iron and steel buildings. The method of making these test we have lately discribed.

A petition to Congress relative to the Paris Exposition of 1900 was read, urging immediate action upon the invitation from the French Government to this country to take part in the Exposition, and to appropriate an adequate sum for the purpose of exhibiting American products.

Mr. Samuel McElroy read a paper on "Water Power of Caratunk Falls, Kennebec River, Maine. One written by Samuel Weber on "Water Power, its Generation and Transmission," was also read. A general discussion of these papers followed. Abstracts of these papers we gave in our last issue.

The remaining time, till 12:30, was taken up by topical discussions. The first of these was "What is the economy, if any, of damper regulation in firing with liquid or ganeous fuel?" It was thought that there was none when gas was used, and very little when liquid fuel was used, but that the supply of air should be regulated before passing through the firebox.

"Are there any conditions under which oil fuel is cheaper than coal for generating steam at points in the Atlantic seaboard states; if so, what are they and when?" was next discussed. It was thought if a man owned an oil well and a coal mine the oil would be cheaper, but as it is, the controlling oil companies keep the price of oil high enough to make the coal cheaper. The Pennsylvania Railroad made experiments with petroleum for fuel for locomotives on that line, but found that if the substitution was made the Pennsylvania locomotives alone would consume half the annual output of the oil companies, and this would soon increase the price of oil so much as to make its use impracticable.

[The conclusion of the Pennsylvania Railroad officers was that their locomotives would consume one-third, not one-half, of the total oil production. For the report of this see the *Railroad Gazette* July 1, 1887.]

At the evening session the following papers were read, each being followed by a discussion: Means Adopted for Saving Fuel in a Large Oil Refinery, by Dr. Charles E. Emery; The Reliability of Throttling Calorimeters, by Prof. Jas. E. Denton; Some Experiments with the Throttling Calorimeter, by Aug. A. Goubert and E. H. Peabody; and Comparative Tests of Steam Boilers with Different Kinds of Coal. An Abstract of Prof. Denton's paper appears in this issue. The discussion was in part as follows:

Mr. Kent: Some 15 or 20 years ago we were told by boiler experts that no experiments were worth anything unless a calorimeter test was made; that boilers gave too much evaporation if not checked by the calorimeter. In a large experiment that I made with both the throttling and the coil calorimeter, I was never able to get more than 3 per cent. of moisture whenever the water level was near its proper place; that is, whenever the water was in sight in the gage. I then came to the conclusion that all boilers that had horizontal shells and were of the ordinary kind did not give a commercially dry steam; that is, steam that did not have over 3 per cent. of moisture in it, and for a long time took the calorimeter test and the result was from ½ to 1½ per cent. Now, Professor Denton tells us that the steam will drain itself in a pipe, so that within a distance of 8 or 10 ft. that pipe will have dry steam, the water being all concentrated at the bottom of the pipe. I think that we shall have to throw away the calorimeter as being unnecessary and come to the conclusion that boilers will give dry steam unless they are foaming, or unless there is some defect in their construction.

Prof. Denton: If the water, before reaching the calorimeter, can be determined, and have the same temperature as the steam, then we know that there has been an extra condensation. Mr. Kent asks us where to place the little calorimeter. It is to be placed at any distance from the outlet to a separator which will not represent the length of pipes. In regard to commercially dry steam, I believe 2 or 3 per cent. represents good enough steam, and would simplify matters if we adopted it as such. I think the conclusion that calorimeters are shown to be of no value is not borne out by facts. I certainly believe we need the calorimeter to show that the separator has done its work.

Mr. Carpenter: I have been making a similar line of experiments as those of Mr. Goubert and Mr. Peabody, and I presume have obtained a similar difference in the thermometer readings. My explanation of this difference differs from that given by M. Goubert. His conclusion from the difference of the readings is not that the sample varies, but that the calorimeters themselves disagree and give inharmonious results. I think that the reason for this variation is not due to any discrepancy in the experiments themselves, but is due to the fact that the sample which was taken by these two instruments was not the same. I also am not prepared to accept another statement made in the paper, and that is regarding the fact that superheated steam can not exist in the presence of water. I am very positive that in some of our experiments in the past year superheated steam did exist a long time in the presence of water. Now as to the amount of error made by the difference in the readings of these thermometers. Professor Denton has very ably shown that there is likely to be a great variation in the samples of steam. I think there is quite certain to be such a variation. It should be noted that with this instrument you have a very large difference in the reading of the thermometer without a very large difference in the results. For instance, a difference of 10 deg. in thermometers—say the steam is 380—makes a difference of less than ½ per cent. in our results. This thing while it looks big on the thermometer has in reality a small effect on the quality of the steam.

Mr. Jacobus: There are two ways in general used for employing the Barrus calorimeter; one is that recommended by Mr. Barrus, and the other is the way Prof. Carpenter has just described, in which a theoretical formula is used. The method which is recommended by Mr. Barrus is to take steam, which he calls dead steam, which simply means that we shut off the pipe from the boiler and draw the steam from that pipe and call that dry steam, and the other is to work with the theoretical formula. If the work is carefully done the two methods agree with each other to within one-fifth of 1 per cent. If you take Mr. Barrus' method and use it carefully and get the right sample of steam, it is by far the shorter method. If you take the theoretical formula, there are a great many corrections you must make.

Mr. Spaulding said that superheated steam in the presence of water was contrary to his ideas. Mr. Carpenter said it was entirely reasonable if you considered that superheated steam is practically a gas and is a poor conductor of heat.

On Thursday morning the discussion of Dr. C. E. Emery's paper on "Comparative Tests of Steam Boilers with Different Kinds of Coal," which was not finished on Wednesday night, was continued. Mr. F. W. Dean, of Boston, whose paper on "The Efficiency of Steam Boilers, a Criticism of the Society's Standard Code of Reporting Boiler Trials," read at the meeting in Detroit last July, resulted in a committee to reconsider the Society's standard code, presented the results of some experiments made by him. These experiments, which extend over several years, compare the two methods of chemical analysis and calorimeter determinations, for obtaining the calorific value of fuel. The record of such determinations, on various grades of coal, are given below.

HEAT UNITS.		Percentage of one to the other.
By chemical analysis.	By Thompson's coal chlorimeter.	
15,043	14,026	93
15 653	14,092	90
13,952	13,450	96
14,403	13,604	94
14,241	13,463	95
15,756	14,654	93
14,666	13,680	93
14,332	13,401	93
14,977	14,092	94
14,400	13,452	93
13,453	13,100	97
Average	....	.....93.73 per cent.

Mr. Kent spoke of the fact that previous determinations had shown that the calorimeter gives results 10 per cent. higher than those obtained by chemical analysis, and also, that the results obtained by the two methods are the same. Since there are thus well authenticated experiments showing results varying 17 per cent., it would seem that the variation was due to the kind of calorimeter used. Mr. Kent believed that the results showing the two methods to give practically the same figures, are correct.

Mr. Dean spoke of the fact that the heat values of constant combustibles are not constant, and that consider able variation will occur in the same grades and kinds of coal.

The first paper read Thursday morning was that by Mr. Albert Kingsbury on the "Friction of Screws." (Abstract in *Railroad Gazette* last week.) Mr. Kingsbury's paper was discussed by a number of the members. Professor Denton thought that the conditions hardly applied to practice, and that an oil of sufficient viscosity to suspend graphite is too thick to use as a lubricant. Several members thought the results extremely valuable, es ecially the coefficients of friction and their value in designing large screws.

Mr. Oberlin Smith said that these results should be supplemented by practical experiments. He had found a coefficient of friction very much higher with fly wheels the tests being made by putting a rope around the wheel and pulling on it with a spring balance, knowing the weight of the wheel, its radius and the area of the bearing.

The next paper read was that on Tests of a Ten-H. P. De Laval Steam Turbine, by W. F. M. Goss. This paper appeared in the *Railroad Gazette* last week. The paper was read by the Secretary, and was not discussed. It was followed by "Recording Device for Testing Machines," by Geo. W. Bissell, also read by the Secretary.

Discussion of the topical question, "What information can you give as to the best method for the extraction of oil from condensed steam, where it is desirable to use the exhaust steam repeatedly for boiler feed purposes?" was then resumed. Mr. Wheeler spoke of English practice, and described the Rankine, and particularly the Edminston feed water heater. (The latter was described and illustrated in the *Railroad Gazette* for May 17, 1895). This filter has several diaphragms of towelling and a perforated plate. It is used on a number of transatlantic steamers. The question of using oil in boilers was brought up, with opinions on both sides of the question.

At the conclusion of the morning exercises lunch was served at the Society's house, after which parties were made up for visiting various places of interest in and about the city. About 50 members visited the works of the Pond Machine Tool Company at Plainfield, N. J. The members left for Plainfield at 1:30 o'clock in a special car over the Central Railroad of New Jersey. In the evening a reception was held at Delmonico's, with supper and dancing.

On Friday morning the meeting opened with the reading of Professor Carpenter's paper, "Effect of Temperature on the Strength of Wrought Iron and Steel." An abstract of this paper was given in the *Railroad Gazette* last week. There was considerable discussion. Mr. H. de B. Parsons, of New York, spoke of the results obtained by the Committee on Tests of Fireproof Building Materials, of which he is a member. It was found that, under a variation in temperature of 2,000 deg. Fahr., steel beams expand or contract from 1.6 to 1.9 per cent. of their length, which in a 30-ft. beam is from 5 to 7 in. This is considerably more than is generally thought to be the case.

The point was brought out that records of the expansion or contraction of beams, etc., should be taken at frequent intervals throughout the test, since such expansion, for instance, does not take place regularly, but advances in a undulating line, being less at a higher temperature in some cases than at a somewhat lower one. The tendency of materials, such as cast iron, to drop to pieces if picked up when at high temperatures was also spoken of. Cast iron at from 1,000 to 1,300 deg. Fahr. becomes amorphous, and loses its power of holding together.

The paper by Mr. P. M. Chamberlain, "Some Data Relating to Forge Shop Design," was then read by the Secretary. There was considerable discussion. This paper was followed by "Experimental Method of Determining the Effective Center of the Light Emitted from a Standard Photometric Burner," read by Mr. D. S. Jacobus. The last paper was "The Proportions of High Speed Engines," by Jno. H. Barr.

In the discussion which followed, Prof. Carpenter spoke of the great variation in size of parts of engines, there being no standard among makers. This is in part due to the particular service and conditions which govern the design of the engine, but largely to the great factor of ignorance which enters into engine designing. Shafts vary, in Mr. Barr's paper, from 16 to 24 in., and other parts in proportion.

Professor Thurston, of Cornell University, read a written discussion. He spoke of Mr. Barr's paper as one of a number of recent investigations tending to rationalize engine design. He advocated the use of safe and economical constants as bases for better and more uniform practice, and spoke of the time when, through a more perfect knowledge of the materials which we are using, and a better understanding of the effect of varying conditions, it will be possible to construct an engine in which we have perfect confidence, with a safety factor of only four.

A letter was read from Prof. W. S. Aldrich, of West Virginia University, discussing this paper, in which the opinion was advanced that the tendency of engine design is toward a perfect theoretical understanding of the stresses in the various parts, so that we may need to depend less and less upon empirical constants.

Further discussion of the question was participated in by Mr. Oberlin Smith, Mr. Kingsbury and others.

The drawings of the steamboat Fulton made by Robert Fulton in 1813, which for many years have been

in the possession of the well-known Schuyler family, of this city, were presented to the society by Miss Louisa Lee Schuyler.

After a brief address by C. F. Billings, the retiring president, in which he thanked the members for the honors bestowed upon him, the convention adjourned.

TECHNICAL.

Manufacturing and Business.

Some idea of the diversity of uses to which electric motors are now being put and the rapid spread of electricity in different directions may be gathered by glancing at the list of orders for motors received in the Power and Mining Department of the General Electric Company, during one month this summer: Operating mining machinery, shoe factory, operating a yarn factory, a tannery, a powder mill, a watch factory, iron working machinery, a foundry, hoists for electric cranes, ventilator on a gunboat, propelling electric launches, the operation of elevators, blowing church organs, operating woollen mills. These orders are scattered through the following states: California, Colorado, Indiana, Ohio, Connecticut, Michigan, Pennsylvania, Rhode Island, Wisconsin and New York, Lima in Peru and Rio de Janeiro in Brazil.

The American Stoker Co., of Dayton, O., has orders for the underfeed stoker made by that company from the Pennsylvania, which is to use two of the stokers in its shops at Columbus, O. The Detroit Steel & Spring Co. has equipped one battery of 12 boilers with these stokers and uses them in other portions of its plant.

The Bickford Drill Co., of Cincinnati, will erect a large new building as an addition to its present plant, which has long been overcrowded and not always able to keep up with orders. The company is especially busy on radial drills, and recent orders for these drills have come from the Cincinnati, Jackson & Mackinaw for its shops at Van Wert, O., and from the Cleveland, Cincinnati, Chicago & St. Louis for two for the new shops at Wabash, Ind. These drills were each 12 ft. high, and with a swing of 168 in.

The new addition to the present building of the Detroit Steel & Spring Co., Detroit, has just been completed. It is equipped with new machinery throughout; but even with this new building in use, the plant is working night and day with three shifts of men working eight hours each.

The Long & Alstatter Co. is very busy at its plant at Hamilton, O. Several new designs for punching and shearing machines are just being introduced.

The Franklin (Pa.) Steel Casting Co.'s plant will be completed and in operation in a few weeks.

Dixon's silica graphite paint, manufactured by the Joseph Dixon Crucible Co., of Jersey City, will be used in painting all the tin work and skylights of the Post Office Department Building at Washington. A quantity will also be used on the Capitol and the District Government Building.

C. E. Brodhead and R. P. Brodhead, as supervising partners of the contracting firm of Brodhead & Hickey, announce the sale on separate dates of the contracting outfit of the former firm: Thursday, Dec. 19, 1895, near Wadsworth Station, on the L. V. R. R., Scottsville Station, on the Rochester division of Erie, and Genesee crossing of Rochester division of Erie, 49 contractor's cars (Ryan & McDonald pattern). Dec. 20, on the Rochester & Honeoye branch of L. V. R. R., about halfway between Rochester Junction and Honeoye Falls, 36 contractor's cars, same as above. Dec. 21, near Lehigh Valley depot, at Geneva, N. Y., 2 Souther steam shovels and a lot of derricks and small tools.

The Chicago Grain Door Company has just received an order from the Ensign Manufacturing Co. for grain doors for 500 box cars recently let by the Norfolk & Western, and from the Lenoir Car Co., for the 100 cars awarded to that company by the Norfolk & Western. The Chicago grain door has also been specified on 500 box cars ordered by the Louisville, New Albany & Chicago from the Haskell & Barker Car Co.

The Edison Electric Illuminating Co., of New York City, have ordered three De Laval steam turbines, which are expected to be placed in one of their power-houses during the next few weeks.

New Stations and Shops.

The Berlin Iron Bridge Co. has just completed for the United States Projectile Co., at South Brooklyn, N. Y., the steel framework for a new annealing room. The building is 100 ft. × 150 ft,. and is designed to be a fireproof structure.

The agreement between the city of London, Ont., and the Grand Trunk for the erection of the company's shops in East London, has been ratified by the council, and will be forwarded to the company's authorities at Montreal for acceptance. The shops must be erected within one year.

The Canadian Pacific produced the plans of the new station and hotel the company purpose erecting at Dalhousie Square, Montreal, at a cost of $350,000. The new station will be 300 ft. long, 66 ft. wide, and built of stone and pressed brick.

The Baltimore & Ohio, which has recently expended $30,000 in making improvements to its property at Alexandria, Va., has just completed a large freight house and station at that place.

Iron and Steel.

The Phœnix Iron Co., of Phœnixville, Pa., has secured the contracts for steel roofs for engine houses along the line of the N. Y., N. H & H., at New Haven, New Milford and Wilson's Point.

The Union Bridge Co. have declined to proceed with the contract for steel work for the ferry house at the foot of Barclay street, New York City, for the Hoboken Ferry Co., because of the delay in approval of plans and the subsequent great increase in the cost of material. The contract has been relet to the Maryland Steel Co. at a considerably increased price.

The Maryland Steel Co., of Sparrow's Point, Md., which has recently taken up bridge and structural work, has received the contract for the steel roof for the sewage pumping station at Providence, R. I.

The East Chicago Iron & Steel Company is reported to have shut down its works. Inability to pay its employees is said to be the cause. Six hundred men are thrown out of work.

The steel rail pool has been reorganized for 1896. The Ohio Steel Co. at Jamestown has been taken in. The pool includes the plants of the Carnegie, Illinois Steel, Cambria, Lackawanna, Bethlehem and Ohio Steel companies. The Pennsylvania Steel Co., Colorado Fuel & Iron and other producers are controlled by agreement.

The Simplon Tunnel.

We noticed last week, page 810, the gathering at Berne, Switzerland, in the middle of November, of a conference of representatives of the contracting company for the Simplon tunnel and of the Swiss and Italian governments. We have learned that the convention between Italy and Switzerland for the construction of the Simplon Tunnel was signed Nov. 25, and contains 26 articles. The programme of the work to be followed is that already approved by the Jura Simplon Company, the Swiss Federal Council and the Italian Government. Italy undertakes to construct approach lines from Domodosola to Isella, a distance of 10½ miles. The Italian Government does not itself grant any subvention, but will use its influence to induce the provinces and towns of Northern Italy interested in the scheme to provide a sum of 4,000,000f. Italy will, however, grant for 99 years an annuity of 3,000f. per kilometer for the portion of the line in Italian territory, which is calculated as equivalent to a capital sum of 1,500,000f. Switzerland will have to provide a subvention of 15,000,000f., of which 4,500,000f. will be found by the Confederation and 10,500,000f. by the cantons and towns interested.

Interesting Locomotive News from England.

The engine now being built by the Midland Railway, to which we referred recently, has eight wheels—namely, a bogie in front, a single pair of driving wheels (7 ft. 9 in. diameter), and a small pair of wheels under the foot plate. The cylinders are of the vast size of 19½ in., and the stroke is 25 in. The boilers are very large, and built capable of carrying, if neccessary, 200 lbs. per square inch, and probably 175 lbs. will be about the working pressure. The engines have the American circular piston valves; and the tenders will carry at least 4,000 gals. of water and five tons of coal. These engines, with tenders loaded, will weigh about 100 tons, and be capable of running, with a train of 150 tons, from London to Leicester, 100 miles, in 100 minutes, if necessary; or, if required, be able to run from London to Sheffield with a stop, and thence from Sheffield to Carlisle. The London & North Western now run from Euston to Carlisle with one stop, and the Midland will soon be in a position to do the same. The Great Northern are making vast tenders to carry water enough to go from King's Cross to York without a stop; while the London & North Western is going to make new bogie engines to supersede their compound system.—*Railway News.*

Engineers and Steel Buildings.

Mr. W. H. Breithaupt, M. Am. Soc. C. E., contributes to the New York *Tribune* for Nov. 25 a well written letter calling attention to the ever increasing need of careful engineering skill in designing, and competent supervision in erecting the large steel skeleton office buildings and other similar structures of the present day. Among other things Mr. Breithaupt says:

"A modern high building not only calls for foremost architectural ability, but presents, both as to its foundations and its superstructure, problems that tax the best engineering resources. It is in no sense a discredit to an architect that he is not also an engineer. The professions of engineering and architecture are intrinsically different, despite the popular idea that they are alike. The predominating element of the architecc's training is to the end of producing the correct and harmonious in form. There are few, if any, men capable of giving a 10 or 20 story building proper arrangement and architectural form—and at the same time able to solve the problems involved in its stable and lasting construction.

It is assumed that the New York building laws guard against unsafe buildings. They do to a limited extent only. In the light of present development these laws are antiquated. With much that is good they contain a good deal that is useless. In so far as they relate to iron construction, for instance, they are inadequate and in some things absurd. All features intended to be covered by the New York building laws are directly the province of the structural, the sanitary or the mechanical engineer. I submit that an efficient building law requires to be framed by engineers, and that provision for its execution should be placed with engineers.

"I have tried to demonstrate that the design and execution of a high building, or of any building where special questions of strength are involved, are as much the work of the engineer as they are that of the architect; and that it is as much to the owner's interest that he should employ a disinterested engineer as that he should employ a disinterested architect.

Allow me to add that my animus has been not to attack architects, but to call attention to facts.

New Electric Railroad in Paris.

It is expected that the electric railroad now building in Paris, between the Place of the Republic and Romainville, will be completed by the first of next month. The total length of the line is seven kilometers, of which four kilometers is in the city proper, and three an extension into the suburbs. The power distribution is by a subterranean conductor, the current being taken at the street level. The power station at Lilas has four steam engines of 200 H. P. which drive the dynamos. From the dynamos the current is taken by a cable placed under the sidewalks to the automatic distributors, which are spaced at about 100 meters apart along the line. From each of these distributors 20 feed-wires run directly to the several contacts. These are metallic pieces of the same size as the paving blocks, and electrically connected in pairs. Once in place, they will not be distinguishable in appearance from the rest of the pavement. The current is taken off by rubbers on the car which strike the contact points, and which, by the automatic action of the distributors, are electrified only during the passage of the vehicle. Each rubber is in contact with two points at a time. Each contact is connected directly to the distributor, and by the intervention of an electromagnet of high electrical resistance, a direct communication is made at once between the principal conductor and the new contact. At the same instant, current ceases to flow through the other point of contact. The current is returned through the wheels and rails. The rails are bonded with each other, and also connected to a continuous wire running under the pavement and between the rails. Twenty cars will be put in service at once, each having two motors of 20 H. P., and each of these cars of 52 seats can also haul another car of 50 seats. It is expected to run the cars at seven-minute intervals, and that the total journey will take 30 minutes. The fares will be 5 cents for seats inside and 2½ cents for outside seats, as far as the gates. These fares will be doubled for the entire journey to Romainville. A charge of 3 cents will be made for packages carried as baggage. Round trip tickets will be sold at a reduction of 25 per cent.

A Trolley Decision.

A decision which seems to be of very great importance to electric railroad interests has just been rendered by Judge Townsend, of the United States Circuit Court, District of Connecticut. It is in the case of the Thomson-Houston Electric Company against the Winchester Avenue Railroad Company. The suit was defended by the Westinghouse Electric Company. We have seen only an abstract of the decision, but from that we judge that the decision confirms the validity of the Van Depoele patent on the under-running trolley and trolley pole. That is, the patent appears to cover effectually the combination of a trolley wheel running under a wire, and of a pole pressed upward by a spring and having at the same time universal motion. This patent is controlled by the Thomson-Houston Company, and therefore, through that company, by the General Electric. In the case of this patent, which, by the way, is No. 495,443, a decree is entered for an injunction and an accounting. As we say, we have not seen the full text of the decision, but if our reading is correct it puts the overhead trolley practically under the control of the General Electric Company.

THE SCRAP HEAP.

Notes.

The Southern Pacific has discharged men in the general offices and in some other departments at San Francisco. Among the men dismissed are the detectives.

The Metropolitan Traction Company has increased the pay of conductors on the Broadway cable car line, New York City. Men who have served one year will now receive $2.25 a day when they work full time.

The coroner's verdict at Cleveland on the drawbridge disaster of Nov. 16, in which a street car with 18 persons fell 120 ft. to the river below, holds that the accident was not the result of reckless and willful disregard of duty on the part of any person or persons liable to criminal prosecution under the laws of Ohio.

The railroads in Pennsylvania, Ohio and elsewhere, which have had to carry water in cars long distances for several months, were finally relieved about Dec. 2. The Lehigh Valley kept several train crews at work and hauled 300,000 gallons a day. The Ohio Central had to spend $75 a day for two months in hauling water.

The Savannah, Florida & Western is now running a passenger train from Jesup, Ga., to Jacksonville, Fla., 115 miles, in 1½ hours, including one stop of five minutes. The time through, including stops, is 46 miles an hour. From Jesup to Waycross this train hauls a sleeping car which runs through from Kansas City to Tampa.

The Brooklyn Heights Railroad Company of Brooklyn, N. Y., is offering for sale 27 steam dummy motors which were used for suburban service before the introduction of electricity as a motive power. It has also for sale a number of street car bodies and some engines, boilers, generators and a lot of miscellaneous equipment, such as car stoves, headlights and fare registers.

The Supreme Court of North Carolina will be called upon to rule on the Sunday freight train question. A citizen of Asheville has brought an action in an inferior court against the Southern Railway for running freight trains on Sunday, and the trainmaster, agent and other

employees were indicted. The Justice rendered judgment against the defendants. An appeal will be taken to the Superior Court.

The Brooklyn Heights (Electric) Street Railroad has put on some cars, painted red, which will be run during the busy hours morning and evening for smokers only. These cars are on the Fulton avenue line, and similar ones will be placed on other lines if the scheme proves successful. It is intended to run these cars eight minutes apart, and to prohibit smoking on the other cars during the hours that these are run.

In Brooklyn, N. Y., Dec. 6, the suit of Eugene F. Medinger against the Brooklyn Heights Railroad Company for $50,000 damages for the death of his wife, Mary Medinger, who was run over and killed by a Court street electric car on March 26, resulted in a verdict of $7,500 for the plaintiff. The company proposes to carry the case to the Court of Appeals, so as to secure a decision on the new constitutional provision which removes the former limit of $5,000 upon verdicts for personal injuries.

The American Federation of Labor has prepared a bill, to be presented in Congress, which aims to prevent by statute the issuance of injunctions like that under which Debs was imprisoned. It reads: "That the courts of the United States, sitting as courts of equity, shall not have jurisdiction to punish for contempt any person charged with the violation of any order or decree of courts whose acts in the premises constitute, arise out of, or are connected with the commission of any offense indictable under the law of the United States or of the State in which the offensive act is committed." The officers of the federation also give out an elaborate explanation of the bill.

Several bills touching upon railroad affairs have already been introduced in Congress at Washington, though every one of them, so far as we have seen, serves only to confirm the prediction, which has been made on all sides, that this Congress intends to devote its energies chiefly to killing time; none of the bills has any prospect of doing any good, or even of passage. Senator Call, of Florida, has introduced one to prevent railroads from attempting to control elections by the use of money or other corrupt means. When a case under this bill comes before the courts, judges and jurors who ride on passes must step one side. Congressman Hardy, of Indiana, has introduced an "important bill" for the purpose of securing to American railroads their rights on traffic coming into this country from Canada, but we cannot make out from the telegraphic report where the importance comes in, or what the honorable gentleman is driving at. Senator Call has introduced another bill, requiring the railroads to continue paying the wages of employees who are injured, and where a man is killed they are to continue paying the regular rate to his widow "during her natural life." Mr. Erdman, of Pennsylvania, has a bill for arbitrating labor troubles.

The Railroads and Higher Education.

The Southern Railway Company has contributed $2,000 to the fund for rebuilding the University of Virginia. The Chesapeake & Ohio recently contributed $1,000 to the same fund.

Cape Cod Ship Canal.

The Massachusetts Ship Canal Company, one of the many corporations formed for the construction of the canal across Cape Cod, failed to deposit $150,000 forfeit money with the Treasurer of Massachusetts, by the date named by the state legislature, and accordingly the act passed by the legislature in relation to its construction of a ship canal across Cape Cod became null and void on Dec. 5.

Another Possible Railroad for China.

Shang-Chi-Tung, Viceroy of Nankin, has ordered an immediate survey to be made of the railroad which it is proposed to construct between Woosung, Shanghai and Soochow. The survey will be carried out by Messrs. John Cockerill & Co., of Seraing, who have sent out two of their engineers, and are guaranteeing the expenses of the Chinese officials to be employed in the survey. It is understood that the Belgian firm is acting on behalf of a powerful Continental syndicate, who are endeavoring to exclude English and American competition.—*Herapath's.*

Lumber for the Northwestern Elevated Railroad.

All the elevated railroads of Chicago employ yellow pine in the construction of their lines. The latest bill out for that purpose is for the Northwestern Elevated, which is constructing an extensive system of lines in the northern portion of the city. The bill is the largest one for yellow pine ever put on the market for structural work in Chicago. It includes the enormous amount of 8,505,000 ft. It is all to be of the long leaf variety.

The schedule is as follows:

	Feet.
Ties	4,100,000
Guard rails	2,400,000
Shims	60,000
Roadway joists	800,000
Roadway planks	700,000
Platform joists	240,000
Platform facing planks	60,000
Furring	20,000
Platform flooring	125,000
Total	8,505,000

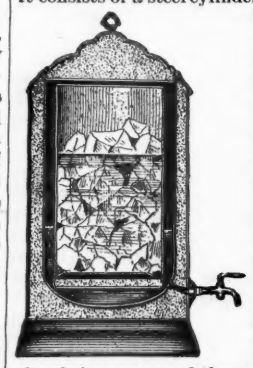
The ties will be 6×8-8, 25 ties for tangents being 9 ft. long; guard rails, 6×8-24 ft. 8 in.; roadway joists, 4×8-8; roadway planks, 2×8-14 to 18; platform joists, 5×6-16, and 4×8 or 9 and 10; facing planks, 1½×14 and 16; furring, 2×6-16; platform flooring, 2×4-20, 2×4-13, and 2×4-9. Beveled ties will be required for 20 per cent. of the roadway, and only the actual timber in these ties will be allowed for, the waste not to be counted.

All the timber must be from untapped trees, sawed true and out of wind, full sized, square cornered. . . . It must be three corners heart timber, dressed smooth on all four faces, and to exact dimensions after planing. The platform flooring must be first class vertical grain lumber, and no piece will be accepted in which the angle of the grain exceeds 45 degrees from vertical. . . . Bidders are warned that the inspection will be thorough, and that the specifications will have to be adhered to, irrespective of all trade or conventional specifications. Though the timber can be three corners heart, and 1 in. of sap is allowed on the fourth corner, and 2½ in. of sap on either side, at either end of the stick the platform flooring must be all heart. The successful bidder will be required to give bond in the amount of $75,000 to secure the fulfillment of his contract. The lumber must bogin to arrive by June 1 next, and the entire bill must be laid down in Chicago by Nov. 1, 1896.

It will be seen that the specifications are very rigid and the conditions exacting. Dealers are looking over the bill as a curiosity, and express themselves as not at all inclined to make bids on it. Experience with the Metropolitan "L" road bill was such that the belief is that no such contract can be undertaken with any prospect of a profitable outcome. But this is a notable bill, and will cut a figure in next season's gulf state sawing. —*Northwestern Lumberman.*

Major's Water Filter.

The ingenious and indefatigable Mr. Major has got up a new water filter which he makes in a design suitable for use in cars and of sizes to fit tanks in present use. It consists of a steel cylinder enameled inside and outside and with a bottom of Gate City stone. In this cylinder are placed the water and ice, the former passing through the stone filter and out through the holes below, seeking a level between the cylinder and the glass or metal cooler, the ice in the cylinder keeping it at a spring-water temperature. The cylinder is made two inches smaller in diameter than the cooler. The Gate City stone used in this filter is a porous stone of exceptional value for filtering and it has for years been used for that purpose in many ways. It has been found that no sediment or foreign matter of any sort can pass it, and after being so passed the water is pure. Its merit is the ease with which the stone can be kept clean by means of Mr. Major's device: simply empty the water from the cylinder, brush the stone base and rinse out.



The Hyde Park Collision.

The Massachusetts Railroad Commissioners have made a report on the rear collision at Hyde Park Oct. 24. The facts are substantially as stated in the *Railroad Gazette* of Nov. 8 and Nov. 29. The first automatic electric signal back of the train was 1,832 ft distant from the point of collision and the next one was 4,977 ft. back. The express train was 1¼ minutes ahead of time when it struck the accommodation After detailing the facts the Commissioners say:

"The weight of the evidence is such as to leave no doubt in our minds that both signals were working properly at the time in question, and that the signal nearer Hyde Park was at danger when the express train approached it. The engineer of that train stands alone in the statement that it was at safety. The most favorable construction is that he did not look at it. Neither did he see the tail lights of the local train until the fireman called his attention to them. His thoughts were evidently somewhere else. The engineer and fireman also testified that the tail lights were hidden by smoke or steam, so as not to be seen at the usual distance; but upon all the evidence we do not find this to have been the fact."

The express train had the best possible air-brake equipment, including brakes on the locomotive truck wheels. The report points out that the engineman made a mistake in reversing his engine, and says that some means should be taken, by instructing engineers or otherwise, to prevent the practice of reversing the engine when the brakes are applied to the driving wheels. Such procedure is admissible only in case the driving-wheel brakes are out of order.

The Commissioners blame the conductor and brakeman as well as the engineman. They suggest that Rule 99 should be improved in its terms so as to apply more specifically to a case like this. Inasmuch as this brakeman had never run on this train before, the conductor ought to have made sure that he performed his duty of throwing off fusees. In summing up they say, further, concerning the engineer, that:

"He was not only aware that the local train was liable to be behind time, but knew (or ought to have known) that he was violating an important rule of safety by running ahead of his own time. Under these circumstances he was bound to run with extreme caution, to observe with extraordinary care the automatic block signals as he passed them, and to keep a sharp lookout for the tail lights or other indications of the train ahead. He did none of these things. After running by Readville Junction at probably double the speed allowed by regulations with which he was familiar, he kept on heedless of all signals, and would apparently have struck the local train when he was under full headway if it had not been for the superior vigilance of his fireman. The most heinous responsibility for the accident lies with the engineer of the express train."

Lake Notes.

Contracts have been closed by O. W. Shipman, of Detroit, Mich., to build and operate, in connection with a Canadian Pacific line to Port Stanley, Ont., a line of two 28-car ferryboats from Cleveland. The distance is 80 miles, and it saves a rail haul all round Lake Erie. The boats will be built on the plan of the Straits of Mackinaw ferries, and will cost over $325,000 each. No contracts for the vessels have been made.

The report of the two Sault canals for November shows a passage of 1,611,020 tons of freight, of which the Canadian canal passed about 9 per cent. The chief items of freight were: Iron ore, 497,351 tons; coal, 338,849 tons; timber, 42,419,000 ft.; flour, 1,378,615 bbls. The total business for the canal up to Dec. 1 for the year had been 14,862,291 tons, and December's traffic, which will be over about Dec. 15, will easily reach a total of 250,000 tons. For 1894 the year's total was 13,195,860 tons; for 1893 it was 10,796,572 tons, and in no year prior to 1883 had it ever reached as much as it has this year.

Some time ago, commenting on the report that 15 lake freight vessels, at an aggregate cost of $2,700,000, and of a season's carrying capacity of 1,500,000 tons of ore, were under way or contracted for at lake yards, it was stated in this column that some additional large contracts would shortly be given out. These have now been closed. Ten 4,000-ton ships are to be built at the lake yards of an aggregate cost of $2,200,000, and with a season's capacity for 1,000,000 gross tons of ore. They are to be constructed as follows: Chicago Shipbuilding Co., three vessels, one a steamer and two barges; Globe Iron Works Co., Cleveland, two steamers; American Steel Barge Co., Superior, one steamer and one barge; and one each at the yards of The F. W. Wheeler Co., Bay City, Detroit Dry Dock Co., and Cleveland shipbuilding Co. The vessels are to be out later in the season. Eight are to be for the John D. Rockefeller interests, and two to add to the already great fleet of the Minnesota Iron Co. Some 12,000 tons of steel will be used in their construction, and some of the material is already ordered. At the Steel Barge Co.'s yard some 800 men will be employed, four vessels being under way and a large number being refitted, redecked and rebuilt. The boats now contracted for at the several yards are to be from 350 to 418 ft. long, and will have an average individual capacity of 4,000 tons on 15 ft. draft. On the 20-ft. channel their capacity will be increased 30 per cent.

Free Railroad Rides in Oakland and Alameda.

It is not unlikely that free riding on the local trains in Alameda is doomed. The accident by which young Austen Delanoy lost his life a week ago caused a coroner's jury to officially declare in effect that the accident would not have occurred had there been guards under the cars to prevent the body rolling under the wheels. Delanoy lost his life by attempting to jump aboard a moving train. The authorities have been petitioned to require the railroad company to have guards put on the cars of all local trains. When the authorities require this, the railroad company may do a great deal more and put gates at the platforms. This, in turn, will abolish free riding, a very great boon in this town, for it is long and narrow, and two local trains traversing its entire length afford its residents uncommon facilities for getting about without the necessity of paying fares. The adoption of gates in Oakland has been remarkably satisfactory. While free riding was in vogue, the average of accidents like the one by which Delanoy lost his life was 76 a year. In the 15 months during which the gates have been in place there has not been one such accident. When it is considered that every accident forms excellent basis for a suit for damages, it is highly probable that the same departure may be made in Alameda.—*San Francisco Call.*

LOCOMOTIVE BUILDING.

The Boston & Albany is about to order several locomotives similar to the Schenectady locomotives built last year for handling the limited trains between Springfield, Mass., and Albany. These engines were illustrated in the *Railroad Gazette* of Oct. 2, 1894.

The Midland Terminal of Colorado, as recently stated in these columns, is now ready to order the equipment for its road. Five locomotives will be ordered, all of the consolidation type, with 20-in. × 26-in. cylinders and weighing about 90 tons An agent is now in the East to contract for the building of these locomotives.

CAR BUILDING.

The Chicago & Grand Trunk is asking bids for building four passenger cars.

The Cleveland, Cincinnati, Chicago & St. Louis will probably shortly order six parlor cars.

The Illinois Central will soon order an additional 200 cars. The specifications include the American steel freight car truck manufactured by the American Steel Foundry Co. of St. Louis.

The Midland Terminal road which has just been built into Cripple Creek, Col., will soon have plans ready for its passenger and freight car equipment. The company will purchase 10 passenger coaches and 100 freight cars.

The United States Car Co. has secured an order from the Chattanooga Southern Railroad Company for 100 cars, which will be built at the Anniston shops. This plant has just been made ready for operation, after being closed about two years.

The Denver & Rio Grande has recently placed orders for building 550 30-ton freight cars, standard gage, delivery in from 30 to 60 days. The Madison Car Company has secured the contract for 300 cars and the Ohio Falls Car Company for the other 200 cars.

The Pennsylvania, it is stated, is shortly to give out orders for building 2,000 additional box cars. These cars, if contracted for, will make 7,500 cars ordered by the Pennsylvania this year. Of the 5,500 cars previously ordered 4,000 were for the lines west of Pittsburgh and 1,500 for the lines east of Pittsburgh, as shown in the statement published in these columns on Nov. 15.

BRIDGE BUILDING.

Anderson, Ind.—The recent storm here blew down the covered bridge over the Missisinnewa at Jonesboro. An iron bridge will probably take its place.

Austin, Tex.—The Attorney-General, on Dec. 6, approved a $5,000 issue of Mills County bridge bonds.

Baltimore, Md.—The Baltimore, Middle River & Sparrows Point (electric) Railroad has awarded to the Structural Iron Erecting Company, of this city, the contract for erecting the iron viaduct to be built over the tracks of the Philadelphia, Wilmington & Baltimore at Highlandtown. The viaduct will be 713 ft. long and 25 ft. high where it crosses the tracks. It will give the company an entrance of its own into the city. The structure will cost about $20,000. Work has been begun and it is intended to have the structure completed so that cars can be running on it in 90 days. The building of this viaduct will practically complete the line.

The stone bridge which is being erected over Gwynn's Falls, on the Franklin Street road, near Calverton, by Patterson & Schribner, contractors, for the Baltimore, Catonsville & Ellicott City (electric) Railway Company, is practically completed.

Bay City, Mich.—There is some talk of a bridge being built across the Saginaw River at this place by the Detroit & Mackinaw Railroad.

Bedford, Pa.—Viewers have been appointed by the court on new bridges over Yellow Creek in Hopewell township and over Wills Creek in Londonderry township.

Boston, Mass.—The question of a proposed bridge over the Charles River was some time ago referred to a joint special committee appointed to decide upon the most desirable form of bridge. The committee has recommended the construction of an iron bridge with a draw, the roadway to be 60 ft. wide, paved. The cost was placed at about $300,000.

Brockton, Mass.—The Boston Bridge Works has received contracts for several plate girder bridges for overhead crossings at points along the line of the Old Colony Railroad near this place, the bridges being made necessary by the separation of grades, which is now being done along this part of the New York, New Haven & Hartford.

Denver, Col.—Bids will be received until Dec. 30 for a bridge over the Grand River in Mesa County, and for a bridge across the Gunnison River in Gunnison County. H. A. Sumner, State Engineer, Denver, should be addressed.

Depew, N. Y.—The Lehigh Valley Railroad is building an overhead crossing at this place. The Elmira Bridge Co. has the contract for the steel work.

Dayton, O.—Action by the City Council was recently taken concerning the plans and estimates for a more adequate bridge on Third street. It was decided to obtain authority from the Legislature at its next meeting to raise the money necessary for its construction. The resolution was referred to the Committee on Bridges.

Easton, Pa.—Work commenced Dec. 3 on the new $200,000 railroad bridge across the Delaware River at this place, and on the railroad which is to connect the Easton & Northern Railroad with the Lehigh Valley Railroad. This road, which is controlled by the Lehigh Valley, extends from Belfast to Easton, Pa., about eight miles. The new connection will give the Lehigh Valley access to the Pen Argyl and Bangor slate fields district. The Union Bridge Co. is building the bridge.

East Rockaway, N. Y.—A bridge from Hog Island Beach to Long Beach is proposed and a company has been organized to push the scheme.

Goldthwait, Mills Co., Tex.—We noted last week the passing of an order to build a bridge across Pecan bayou at Jackson's crossing. Press reports say that a strong effort will be made by the citizens of the county to prevent the construction of the bridge.

Hallettsville, Tex.—Bids will be received until Dec. 19 for an iron bridge over Supple Jack Creek, on the Hallettsville & Victoria road, north of Hope. Proposals for repairing two other county bridges will also be received. Address J. W. Rees, Clerk, Lavaca County.

Indiana, Pa.—Two petitions have been presented to the County Commissioners asking for a bridge over Little Mahoning Creek near Frantz's mill. The court has passed favorably upon the matter.

Indianapolis, Ind.—We recently published in these columns a list of the bids received for the plate girder bridge on Meridian street over Pleasant Run. All the bids were rejected. Press reports say that not enough money could be appropriated to pay for the bridge until after the first of January. Bids will be re-advertised for.

Plans have been drawn up in the office of the City Engineer for a viaduct over the Panhandle tracks 300 ft. long with an approach of about 120 ft. at each end. This will give the citizens of Woodside a direct entrance to the city without crossing the tracks, of which there are five, at grade. The project is to be submitted to the Board of Public Works at an early meeting.

Bids will be received until Dec 18 for a bridge over White River at Raymond street. Joseph L. Hunter, Chairman Board of County Commissioners, Marion County, should be addressed.

Kansas City, Fort Scott & Memphis.—This railroad has recently contracted with the Pencoyd Iron Works of Philadelphia, for various steel bridges, as follows:

SINGLE TRACK PLATE GIRDER BRIDGES.

No. 203, deck, 2 spans, 44 ft. each.
" 204, deck, 2 spans, 30 ft. each, and 1 span half through, 40 ft.
" 205, deck, 2 spans, 40 ft. each.
" 68, half through, 1 span, 80 ft.

SINGLE TRACK PIN-CONNECTED TRUSS SPANS.

No. 153, through, 1 span, 140 ft.
" 167, through, 1 span, 132 ft. 6 in.
" 191, deck, 1 span, 100 ft.
" 196, through, 1 span, 140 ft.

The total weight covered by the contract is about 600 tons.

Port Royal & Western Carolina.—A steel viaduct to be built across a branch of the Congree River at Enoree, Ga., is under contract with the Edge Moor Bridge Works. It will be 800 ft. long and 45 ft. high at the highest point, with an 80-ft. plate girder span over the river. Messrs. R. W. Hildreth & Co., of New York, are the Consulting and Inspecting Engineers.

Kansas City, Mo.—Bids have been received for a wrought iron bridge and two stone bridges by F. J. O'Flaherty, County Surveyor.

Los Angeles, Cal.—It is reported that two bridges will soon be built over the Los Angeles River at this place, one to be at Mary street and the other at Aliso street.

Maine Central.—Various new steel bridges are to be built on the line of this railroad as follows: By the Boston Bridge Works, Brewer Bridge, between Bangor and Brewer, across the Penobscot River, composed of four through and two deck pin-connected truss spans; Costigan Bridge, a through plate girder, and Wytopitlock, Fin Brook, Meadow Brook and Lowells bridges all small deck plate girders; by the Edge Moor Bridge Works of Wilmington, Del., a double-track structure across the Penobscot River, known as the "Penobscot Bridge," composed of a deck pin-connected span and two approach deck, plate girder spans; Cumberland Mills bridge at Cumberland Mills, three double track deck plate girder spans, and Brown street bridge at the same place, an overhead street crossing composed of one double track, through, plate girder span.

Media, Pa.—Supervisor Stiteler, of Media, is having a new bridge constructed at the breast of Broomall's dam. The old bridge was in a very bad condition.

Middletown, O.—It is reported that all bids received for a bridge across the canal at Franklin street, Middletown, have been rejected. The County Commissioners will readvertise for bids to be opened Jan. 7. The bridge will be a lift bridge. Frank X. Duer, Hamilton, O.

Mobile, Ala.—The Youngstown Bridge Co. has secured the contracts for three steel bridges near this city, the contract price being $5,700.

New Castle, Pa.—Steps have been taken here to build a new county bridge across the Neshannock River above Pearson's dam.

New York & New England.—Since the recent reorganization of this road a considerable number of wooden and old iron bridges are being replaced with modern steel structures. The larger bridges on the line are in pretty good condition, so that present contracts cover only short spans. The Pennsylvania Steel Co. has under construction various plate girder spans for bridges numbered 3, 5, 8, 12, 45, 58, 75, 79, 84, 88, 89 and 91. The Elmira Bridge Co. has the contract for a transfer bridge at Fishkill, N. Y., composed of three lattice girder trusses each 75 ft. long.

New York, Pennsylvania & Ohio.—Bridge No. 27 is to be replaced by a new steel, pin-connected truss span by the Elmira Bridge Co.

Norristown, Pa.—The Commissioners expect to shortly invite proposals for the new Airy street bridge over Stony Creek, to cost about $40,000. It is to be completed early next year.

Northampton County, Pa.—Messrs. Nelson and Buchanan, of Chambersburg, Pa., have the contract for a steel bridge across Martin's Creek, and have sublet the steel work to the Pittsburgh Bridge Co. J. M. Porter, Professor of Civil Engineering in Lafayette College, Easton, Pa., is the Consulting Engineer.

Osceola, Wis.—Work on the new wagon bridge across the St. Croix River at this place has begun. It is being built by the Milwaukee Bridge and Iron Co. at a contract price of $11,200. Funds are provided by Osceola village bonds of $4,300; taxes, $1,600; private subscription, $1,600; Franconia, Minn., private subscription, $1,000; "Soo" Railway Company subscription, $2,700.

Philadelphia, Pa.—We noted last week the steps being taken to secure a new bridge at Gray's Ferry, over the Schuylkill. A section of the bridge collapsed on Dec. 4, owing, it is said, to the breaking of a tie rod. The bridge is used by the Pennsylvania Railroad. Repairs were begun at once.

Reading, Pa.—Viewers have recommended the erection of a new iron bridge over Spring creek on the boundary line between North and Lower Heidelberg townships, reporting the present wooden structure, 43 ft. long and 12 ft. wide, as unsafe. They also recommended that the new bridge be 50 ft. long and 15 ft wide. The cost will be about $1,500.

Rochester, Minn.—A bridge is to be built across the Zumbro River at Fifth street, with a 200-ft. span.

San Francisco, Cal.—The Board of Supervisors has received bids for an 85-ft. iron or steel bridge, to be constructed at the intersection of Charles and French streets.

Scotland, Pa.—L. C. Faber, of Carlisle, has the contract for a new bridge over the creek at the Soldiers' Orphans' Industrial School.

South Norwalk, Conn.—There are several small plate girder spans for highway crossings on the Danbury Division of the N. Y., N. H. & H. contracted for with the B. F. Hawkins Iron Works, of Springfield, Mass. The Monroe street crossing at this place comprises a four-track, plate girder span and a skew pin connected span, weighing about 500 tons. The Berlin Iron Bridge Co., of East Berlin, Conn., are the contractors. The Norwalk River bridge is a four-track structure, three approach spans, deck lattice girders, each track being carried by a separate pair of girders, and one 200-ft. deck draw span of three lattice trusses. The total weight of the structure will be about 2,500 tons; and although the draw span will be a very heavy one, there will be no specially interesting features in connection with the drum except the distribution of weight by four heavy cross girders. The drum has a single web, and is 46 ft. 6 in. in diameter. The contractors are the Pennsylvania Steel Co., of Harrisburg, Pa., for the superstructure, and Mairs & Lewis, of New York, for the substructure.

St. Louis, Mo.—The House of Delegates have passed the Clark avenue bridge bill. It provides for the construction of a bridge over Clark avenue from the west line of Moore street to the east line of Twenty-first street, to open Clark avenue over the grounds of the Union Depot Company, between Eighteenth and Twentieth streets.

Swathmore, Pa.—The stonework of the bridge over Crum Creek, at Stathhaven Inn, is completed. The ironwork will be begun at once.

Troy, N. Y.—At a recent conference between the Troy City Railway and a committee of the City Council, the subject of a bridge over the Mohawk at Ontario street was discussed.

Wheatland, Pa.—The Canton (O.) Bridge Co. has begun work upon the iron superstructure of a new county bridge at this place.

Youngstown, Ohio.—The Commissioners of Mahoning County, backed by the Board of Commerce, will expend nearly $300,000 during the coming year in the erection of two very large overhead bridges and a grade bridge over the Mahoning River. The bridges will be constructed with separate roadways for the electric lines.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Albany, $2 per share, payable Dec. 31.
Boston & Lowell, 3½ per cent., payable Jan. 1.
Chicago & Eastern Illinois, quarterly, 1½ per cent., on the preferred stock, payable Jan. 2.
Chicago & Northwestern, quarterly, 1¾ per cent., on preferred stock; also semi-annual, 2½ per cent., on common stock, payable Jan. 3.
Cleveland, Cincinnati, Chicago & St. Louis, quarterly, 1¼ per cent., on preferred stock, payable Jan. 2
New York & Harlem, 4 per cent. guaranteed by New York Central & Hudson River, payable Jan. 2.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Central Massachusetts, special, Union Station, room 15, Boston, Dec. 16.
Pennsylvania & New Jersey, special, office of the company, southeast corner of Delaware and Federal streets, Camden, N. J., Dec. 19.
Rome, Watertown & Ogdensburgh, annual, company's office, New York, Dec. 28.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The American Society of Mechanical Engineers will hold its annual meeting at the Society's rooms, 12 West Thirty-first street, New York City, Dec. 3 to 6.

The *Western Railway Club* meets in Chicago on the third Tuesday of each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Tuesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the second Friday of January, March, May, September and November, at 2 p. m.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *Northwestern Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Western Society of Engineers* meets on the first Tuesday in each month, at 8 p. m. The headquarters of the society are at 1736-1739 Monadnock Block, Chicago. The business meetings are held on the first Wednesday at its rooms. The meetings for the reading and discussion of papers are held on the third Wednesday at the Armour Institute, Thirty-third street and Armour avenue.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, 36 Bromfield street, Boston, on the third Wednesday in each month, at 7.30 p. m.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Engineers' Society of Western Pennsylvania* meets in the Carnegie Library Building, Allegheny, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Association of Engineers of Virginia* holds informal meetings on the third Wednesday of each month, from September to May, inclusive, at 710 Terry Building, Roanoke, at p. m.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second Tuesday of each month except during July and August.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The *Engineers' Club of Cincinnati* meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month, at 7.30 p. m. Address P. O. Box 333.

The *Engineers' and Architects' Club of Louisville* meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday each month at 8 p. m.

The *Western Foundrymen's Association* meets in the Great Northern Hotel, Chicago, on the third Wednesday of each month. S. T. Johnston, Monadnock Block, Chicago, is secretary of the association.

The *Association of Civil Engineers of Cornell University* meets on Friday of each week at 2:30 p. m., from October to May, inclusive, at its association rooms in Lincoln Hall, Ithaca, N. Y.

The Engineers' and Architects' Association of Southern California meets each third Wednesday of the month in the Hall of the Chamber of Commerce, Los Angeles, Cal.

The Engineers' Society of Western New York holds regular meetings the first Monday in each month, except in the months of July and August, at the Buffalo Library Building.

New England Railroad Club.

The subject for the next meeting will be the "Number and Location of Grabirons or Handholds and Height of Drawbars, as applied to Freight Cars."

Western Foundrymen's Association.

The next meeting of the Western Foundrymen's Association will take place at the Great Northern Hotel, Chicago, Wednesday, Dec. 18, at 7:30 p. m. A paper will be read by Mr. P. S. Dingey, Mem. A. S. M. E., on "The Care of Patterns and Pattern Account." The report of the Committee on By-Laws presented at the last meeting will be discussed, and the new by-laws will be adopted. A lunch will be served after the meeting.

Roadmasters' Association.

The Executive Committee of the Roadmasters' Association met on Monday, Dec. 9, at the Great Northern Hotel, Chicago, to choose new subjects and to appoint committees for discussion at the next convention. There were present: Mr. C. E. Jones, Pres. C., B. & Q.; J. A. Kerwin, V. P., C. & N. W.; J. B. Dickson, Sec. C. & N. W.; W. A. Otis, N. Y. C. & H. R.; John Doyle, D., L. & N.; J. B. Moll, M. & St. Paul; I. O. Walker, P. T. & A. & T. M.; G. Davis, B., C. R. & N.; H. G. Hetzler, C., B. & Q., and W. H. Stearns, Budy Fdy & Mfg. Co.

Engineers' Club of St. Louis.

The annual meeting was held at the club's room, 1,600 Lucas place, St. Louis, Dec. 4. The nominations for officers for the coming year were as follows: For President, J. A. Ockerson; Vice-President, Edward Flad, B. H. Colby, N. W. Eayrs; Secretary, William H. Bryan; Treasurer, Thos. B. McMath; Librarian, W. A. Layman; Directors (two to be chosen), S. Bent Russell, Carl Gayle, Wm. Bouton, Julius Baier, M. L. Holman, B. L. Crosby; Representatives on the Board of Managers of the Association of Engineering Societies, J. B. Johnson and W. E. Barns.

Prof. J. H. Kinealy exhibited a model and delivered an address on an improved form of draft gage.

Mr. C. H. Sharman read a paper on "Smoke Prevention," by R. J. McCarthy, of Kansas City. The paper was read at a recent meeting of the Engineers' Club of Kansas City. A general discussion of the subject followed Mr. Sharman's reading.

The annual supper of the club will be given on Wednesday evening, Dec. 18.

Civil Engineers' Society of St. Paul.

A regular meeting of the society was held Dec. 2 There were 11 members and one visitor present.

Mr. Davenport described the three classes of earth slides which occur along the Red River of the North. The most remarkable have taken place two or three years after great floods (such as those of '82 and '93) when suddenly vast masses of the banks, several hundred feet wide and from 30 to 50 ft. high, sink abruptly, and from 150,000 to 250,000 yards of the deeply underlying clay strata slide into the river, there being no horizontal movement of the upper mass.

Mr. Hilgard mentioned the fact that a pier of the N. P. R. R. bridge at Bismarck, N. D., slid 27 in. out of position, presumably on a bed of clay moistened by leakage from the city reservoir.

Mr. Crosby described his recent impressions of the sugar plantations and levees above New Orleans.

Mr. Estabrook stated that a saving of about 20 per cent. has been effected by substituting a triple for a double expansion engine at the Washburn-Crosby flour mills in Minneapolis.

Boston Society of Civil Engineers.

A regular meeting o f the society was held on Wednesday, Nov. 20. President A. F. Noyes presided; 69 members and visitors were present.

The resolution submitted at the last meeting by the Committee on Weights and Measures in relation to a uniform standard of thicknesses for metals was considered, and after discussi n was amended so as to read:

Resolved, That the Boston Society of Civil Engineers earnestly deprecate the use of any of the wire and sheet metal or other trade gages now in vogue, and strongly urge the use of a decimal system for all such measurements.

Mr. R. W. Lesley, Treasurer of the American Cement Company of Philadelphia, read a paper entitled "Progress of the Manufacture of Portland Cement in America."

December Meeting.—At the meeting to be held on Dec. 18, 1895. Mr. George S. Rice will occupy the evening with "Some Notes Concerning the New Croton Aqueduct," illustrated by lantern slides.

PERSONAL.

—Mr. Sylvester Deming has been appointed Treasurer of the Panama Railroad, in place of Mr. E. L. Oppenheim, resigned.

—Mr. R. L. Herbert has been appointed Master Mechanic of the Southern Pacific at Victoria, Tex., vice Mr. I. R. Garnott, transferred.

—The representative of the Grand Trunk on the Board of Managers of the Joint Traffic Association is Mr. Burton, the General Freight Agent.

—Mr. Joseph H. Thompson, Assistant Superintendent of the Western Division of the Southern Pacific, has been appointed Superintendent of Terminals at Oakland, Cal., a position recently created.

—Mr. Herman Johansson, Mechanical Engineer of the Swedish State Railroad, died on Nov. 26. He had been away from his home in Stockholm about a month and returned ill, never leaving his room afterward.

—We recorded very lately the death of Mr. Patrick Sterling, the veteran Locomotive Superintendent of the Great Northern Railway, England. That vacancy has been filled up by the appointment of Mr. H. A. Ivatt, the Locomotive Engineer of the Great Southern & Western Railway of England.

—Mr. H. A. Tuttle, General Superintendent of the American District Telegraph Company at St. Paul, has been appointed Superintendent of Telegraph of the Minneapolis, St. Paul & Sault Ste. Marie. Mr. Tuttle succeeds H. W. Thomas, deceased, and it is understood will not resign from the telegraph company's service.

—Mr. Richard Durborow has been promoted to be Master Mechanic of the West Philadelphia shops of the Pennsylvania, vice M. Garrett, retired, and R. H. Garland has been promoted from General Car Inspector, with headquarters at Altoona, to be Assistant General Foreman of the West Philadelphia shops, vice Mr. Durborow.

—Mr. T. W. Adams has just been appointed Master Car Builder of the New England road, in charge of the shops at Norwood, Mass. Mr. Adams has been recently with a varnish manufacturer, but was formerly Foreman of Car Repairs of the Boston shops of the Boston & Albany Railroad. He is a son of Mr. F. D. Adams, Master Car Builder of that road.

—Mr. A. C. Bird has been appointed General Traffic Manager of the Chicago, Burlington & Quincy, to succeed Mr. E. P. Ripley, who has been appointed President of the Atchison, Topeka & Santa Fe road. Mr. Bird is now Freight Traffic Manager, having been appointed to that office early in 1889. He was formerly General Freight Agent, and has been with the company since 1882.

—Mr. Samuel G. Lewis, ex-comptroller of the Pennsylvania Railroad, died at his home in Philadelphia on Dec. 10. He was born in Pottsville, Pa., Oct. 17, 1827. In 1853 he entered the accounting department of the Pennsylvania Railroad, and was successively assistant auditor, auditor and comptroller, which position was created with him. He resigned in 1874, after 21 years of service.

—Mr. Thomas Tobin, who was conductor of the westbound train that was in the disastrous collison at Nichols, Mich., October 20, 1893, died last week in an insane asylum at Toledo, O. His mind began to fail soon after the collison, and he gradually failed, down to the time of his death. It is said that Mr. Tobin's experience in the collision was the cause of his insanity, though neither he nor any one on his train was at fault.

—Mr. A. J. Earling, General Manager of the Chicago, Milwaukee & St. Paul, has been appointed Second Vice-President. This is the office resigned by Mr. Ripley, who goes to the Atchison. Mr. Earling will continue as General Manager. He was appointed to that office five years ago. His entire service has been with the Chicago, Milwaukee & St. Paul. He was a telegraph operator in 1866 and he has served in every grade of the operating department.

—Mr. T. S. Inge, of Raleigh, who has been made Master Mechanic of the new shops of the Southern, at Burlington, N. C., and will have jurisdiction from Greensboro, N. C., via Burlington, Raleigh and Selma to Goldsboro, N. C., and from Selma to Norfolk, Va.; also of the Durham & Northern road, operated by the Southern, and other short branches. All the repair work on these divisions of the Southern will hereafter be done at the new shops at Burlington, N. C.

—Mr. W. S. Alexander, until recently President and General Manager of the Eastern Railway of Minnesota in St. Paul, is now assistant to Judge Cornish, the Special Master in Chancery of the Union Pacific in Omaha. The position is an important and remunerative one. The duties of the office are to examine all accounts submitted to the court and investigate all complaints and queries regarding the receivership brought before the courts. Mr. Alexander was for several years prior to 1882 General Freight and Ticket Agent of the St. Paul, Minneapolis & Manitoba; from Sept., 1882, to Feb. 1, 1890, General Traffic Manager, and to July, 1890, General Traffic Manager of the Great Northern. From Dec. 1, 1890, until about a year ago, he was President and General Manager of the Eastern Railroad of Minnesota.

ELECTIONS AND APPOINTMENTS.

Alabama Midland.—The stockholders held their annual meeting in Montgomery, last week and elected these Directors: Messrs. H. B. Plant, M. F. Plant, H. M. Flagler, H. H. Flagler, R. G. Erwin, Frank Q. Brown, D. F. Jack, W. F. Vandiver, William K. Pelger and O. C. Wiley. The directors had a meeting and elected the following officers: President, H. B. Plant; Vice-President, M. F. Plant; Secretary, R. B. Smith; Treasurer, J. M. Lee.

Annapolis & Baltimore Short Line.—The annual meeting of the directors of the road was held at Baltimore last week. The officers elected were: J. S. Ricker, President; J. Hopkins Smith, Vice-President; C. A. Coombs, General Manager, and L. A. Burck, Secretary. The directors were: J. S. Ricker, George Burnham, Jr. J. Hopkins Smith, Sumner Wallace, C A. Coombs, F. E. Fennessy, J. B. Huckins, John Glen and W. W. Brown.

Atlantic Coast Line.—R. E. Smith, Master Mechanic at Norfolk and Foreman of the Lambert's Points yards of the Norfolk & Western, has resigned, to take a somewhat similar position at Wilmington, N. C., with the Atlantic Coast Line.

Bare Rock, Pa.—The annual meeting was held last week. John Murdock being elected President; J. M. Murdock, Treasurer; W. F. Murdock, Secretary. J. C Duncan, of Johnstown; E. D. McColly, of Ligonier, and John K. Fox, of Somerset, are the other Directors.

Cleveland, Akron & Columbus.—James A. Curtis has been appointed Contracting Agent for this company at Cleveland, O.

Pittsburgh, Cleveland & Toledo.—At the annual meeting at Youngstown, O., Dec. 3, Directors were elected as follows: J. V. Patton, E. S. Wright, J. R. McCreary, Pittsburgh; Thomas M. King, Philadelphia; Orlando Smith, Columbus; L. E. Cochran, Youngstown; W. J McKinnie, Cleveland; David Lee, Zanesville; S. P. Peabody, J. W. Collins, Columbus; R. T. Devries, Wheeling

Smethport & Olean.—The company has been incorporated in Pennsylvania, with George G. Wolf, of Bradford, Pa., as President, and the following Directors: George J. Wolf, President, and A. G. McComb, James George, H. A. Jackson, S. H. Smith and M. J. Raub, all of Bradford, Pa.

Union Pacific.—Judge William R. Kelley has been appointed General Solicitor of the company, to succeed John M. Thurston, resigned on account of his election to the United States Senate.

RAILROAD CONSTRUCTION,
Incorporations, Surveys, Etc.

Atlanta, Knoxville & Northern.—The Atlanta, Knoxville & Northern Railway Construction Co., of New York City, has been organized in New York State to deal in railroads and railroad equipments. The capital is $92,000, and the Directors are Charles E. Kimball, Matthew McLanahan and George Mumford, of New York.

Choctaw, Oklahoma & Gulf.—General Manager Wood has put a party of surveyors in the field running a line for an extension of the road west from Fort Reno, via Arapahoe, to connect with the Fort Worth & Denver at Canadian, Tex. Construction will begin in the early spring. Surveyors are also in the field running a line for a branch of the road from Calvin, I. T., to Denison, Tex., and propositions have been submitted to Fort Smith and Van Buren, Ark., looking to an extension of the road east to those points from Wister Junction or Red Oak.

Coast Railway of Nova Scotia.—The work of construction is being rapidly pushed on this road from Yarmouth, Nova Scotia. Track will be laid to Belleville, 14¼ miles, by Dec. 15. All the masonry is completed on this section. Station buildings at Arcadia, Tusket and Belleville are practically completed. The Salmon River steel bridge, consisting of five spans of 41 ft., plate girders, has been erected in place, and the Tusket River bridge has been delivered at the bridge site and work of erection commenced. The bridge consists of three spans, 61-ft. deck plate girders; two spans, 103 ft. each, lattice trusses. These bridges were built by the Central Bridge & Engineering Co, of Peterborough, Ont. Track between Yarmouth and Salmon River, eight miles, is now pretty well ballasted; fencing is nearly all completed to Salmon River. Box and platform cars have been received from Rhodes, Curry & Co., of Amherst. N. S ,who are also building two passenger cars and one combination car, to be delivered Jan. 1. It is proposed to open this section of the road, Yarmouth to Belleville, about Jan. 15. The line beyond Belleville has been graded a farther distance of about 15 miles, and it is proposed to lay track and complete this portion of the line (15 miles beyond Belleville) for operation by May 1 next. The entire line to Lockport is about 100 miles, on which the surveys have been completed, right of way secured, and this portion of the line will be pushed to completion next season. The Nova Scotia Development Co. is building this road. Its officers are: John A. Brill, President, Philadelphia, and George A. Fletcher, same place, Treasurer. The officers of the Coast Railway Co. are: Thomas Robertson, President; S. D. Pettit, Secretary, and L. H. Wheaton, Yarmouth, N. S., Chief Engineer.

Cumberland Valley.—It is reported that the company is considering the project of extending the Mont Alto branch to Fayetteville, Md., Greenwood and other towns close by. The extension would mean the building of perhaps 10 milas of track. The Mont Alto road now extends from Mont Alto Junction, on the Cumberland Valley road, to Waynesboro', where it connects with the Western Maryland.

El Paso & Northern.—This company has been reorganized, with W. L. S. Thorne, General Manager of the Texas & Pacific, as President; C. R. Morehead, of El Paso, Tex., Vice-President, and B. F. Darbyshire, of El Paso, as Treasurer. These officers, together with C E. Satterlee, of New York; W. S. Abrams and E. D. Sargent, of Dallas, comprise the Board of Directors. The El Paso Northern is the old White Oaks Road, 10 miles of which was built out of El Paso, northeast, in 1889, by Morris R. Locke & Co. On the completion of 10 miles of track the road went into the hands of a receiver. In 1891 the people of El Paso and other counties organized to complete the road under the name of the El Paso & Denver Short Line. But soon after the Texas & Pacific bought the road from the receiver. Recently C. B. Eddy offered to complete the road to the rich mineral fields of White Oaks, if El Paso would give a subsidy, but his project will be blocked if the Texas & Pacific starts building.

Ishpeming & Lake Superior.—Construction on this road, referred to a few weeks ago, has begun at Marquette by Winston Bros., of Minneapolis, and R. B. Dear, of Duluth, contractors. The present section of the road will be about 15 miles long, from the mines at Ishpeming and Negaunee to the mouth of Dead River, near Marquette. It will have a maximum grade with traffic, of 1.63 per cent. and a curvature of not over 5 degs. It will be laid with 80-lb. rails, and will have steel bridges. A 6-track ore dock, 52 ft. to dock, with 200 150-ton pockets, will be ready by June next. The road will be controlled by interests represented in three very large Marquette Range mines which alone can give it not far from 900,000 tons of traffic annually. Its chief engineer is S. S. Neff, and the offices are at Marquette.

Kansas City, Watkins & Gulf.—Prof. P. H. Philbrick, Chief Engineer of the road, reports that the engineers, who are making the second survey for the extension from Alexandria to Natchez, Miss., have reached a point about 25 miles from Alexandria. The whole distance is about 80 miles.

Lake Erie & Detroit River.—The company is applying to the Dominion Parliament for power to extend its line from Simcoe to Fort Erie, Ont.

Lehigh Valley.—Calvin E. Brodhead, of New York, and Robert P. Brodhead, of Kingston, Pa., who received the contract for grading the Easton & Northern extension through Palmer township, west of Easton, Pa., began work last week. This is a new line of about four miles to connect with the Lehigh Valley, which operates the Easton & Northern. The work includes a bridge across the Lehigh River.

Lima Northern.—The track north of Lima, O., is completed to West Cairo, and a large force of men is engaged on the tracklaying between that point and Columbus Grove. Five construction trains are being used in the work.

The company has entered for record in various counties in Ohio, a $1,200,000 mortgage with the Manhattan Trust Co., of New York, as Trustee. The contract for building the bridge across the Maumee River at Napoleon, has been let to the Toledo Bridge Company.

Maine Central.—The company is making many improvements in its roadbed and equipment. The work of replacing the old rails with 90-lb. rails on the line east from Portland is being pushed. The new steel bridge between Bangor and Brewer, which takes the place of the wooden one, is being erected by the company's own crews. The bride consists of two deck spans and four through spans. The burned station at Brunswick is to be replaced by a stone structure next spring.

Midland Terminal.—The company is working rapidly to complete a great trestle work to span Poverty Gulch, the last heavy piece of work to be done before the road is completed into the town of Cripple Creek, Col. Two bridges between the town and the Anaconda mines are yet to be built, and then the track-laying will be completed to a point where a siding can be put in that passengers may be landed within the city limits. By Christmas time the company expects to be running regular trains to its terminus in Cripple Creek. The rapid increase of interest in the camp has materially benefited traffic on the Midland Terminal. All its sidings are filled with loaded cars of machinery and merchandise going into the district, and rolling stock sufficient to take out the ore is hard to find. The earnings of this new road for this year will show a handsome profit.

Messrs Blair & Co., after a recent examination of the property and the prospects of the Cripple Creek district, have become financially interested in the railroad, and will become its Eastern financial agents. At present the road is using Atchison and Colorado Midland rolling stock, but the company will immediately order new equipment. The rights of way of this company are now quite valuable, and will continue more so as the camp develops. The line crosses hundreds of mining claims and belts the entire district, so that mines can avoid wagon hauls to the cars. No mining camp in Colorado has better transportation facilities.

Moore County.—A new road is to be built from Aberdeen, in Moore County, to Fayetteville, Cumberland County, N. C., the latter being a town of considerable importance, with 6,000 population, where two new cotton factories and a cotton bleachery are to be built at once; and it is at the instance, partly, of the projectors of these proposed industries that the road is to be built, in order to afford better transportation facilities for the output of the mills. It is stated that the new line will be an extension of this road, of which W. B. Eckhout, of Aberdeen, N. C., is Manager. It will connect with the Atlantic Coast Line and Seaboard Air Line. The Aberdeen & West End road, of which Mr. A. F. Page is President, and which has just completed an extension to Troy, N. C., may become concerned in the building of this new line from Aberdeen to Fayetteville, the exact details of which have not all been yet arranged.

New Roads.—Robert Campbell, E. Adams and others, of Colmesneil, Tylor County, Pa., are organizing a company to construct a road from Stark's landing, 12 miles south of Newton, on the Sabine River, westward into pine timber, to be used as a tram road for running timber to the river, whence it can be floated to market at Orange. They are negotiating for narrow gage equipment and track.

The Duck River Phosphate Co. will have a road from Totty's Bend to Centreville, Tenn., a distance of nine miles, which it has been building, completed in a few weeks. The phosphate rock heretofore has been hauled by wagons and on barges by the river. The company ships about 100 tons of rock a day.

Surveys are being made for a narrow gage road from the mines at Rossland, in the southern part of British Columbia, to extend to the smelter at Trail, B. C. It is proposed to build branches from the main line of the proposed road to all the principal mines. Breen & Heinze are the promoters.

Opelika & Layfayette.—The work on the road building under this name from Opelika to Lafayette, Ala., a distance of 22 miles, is reported to have been suspended last week. Two miles of track have been laid, and over eight miles of the line graded. The contractors became involved, and were finally forced to stop work.

Ottawa, Arnprior & Parry Sound.—The last 10-mile section, on the western end of the road, extending from Whitefish Lake to Cache Lake, the present end of the track, has been approved by the government engineers. Cache Lake will be the terminus of the operated line for this year. It is 164 miles west of Ottawa. The western end of the road will be completed into the Basin Harbor, at Parry Sound, this week. The company will, this winter, begin to bridge 'the Narrows," a deep channel that separates the mainland from the island opposite the town, upon which the company's depots and docks will be built.

Patten & Sherman.—The grading is now completed on the five and a half miles of road connecting Patten with the Bangor & Aroostook. The rails will be laid this month. The town of Patten gave $15,000 and citizens gave another $5,000, to aid in building the road

Pennsylvania.—Substantial progress has been made on the extension of the Philadelphia, Bustleton & Trenton branch, since the work was started again, early in October last. The contractor is Charles McFadden, of Philadelphia, whose firm had the contract for the extension of the line, when the railroad directors suspended all construction work, in 1893. The work has been previously noted in these columns, but it is of enough interest and importance to describe more particularly. The new line is only 3½ miles of double track, but with the connections it makes with other branches it will shorten the New York & Philadelphia division of the Pennsylvania, and permit higher speed to be maintained near Philadelphia. The branch extends from a point on the New York division of the Pennsylvania, one-half mile east of North Penn Junction, thence very directly in a northeasterly direction to Bustleton, a distance of eight miles. From this point the road will ultimately be extended directly east to the vicinity of Trenton, a further distance of about 16 miles. When the road is entirely completed it will give the Pennsylvania almost an air line between Trenton and Philadelphia for through express and freight trains at high speed. The contract, now being carried out by Mr. McFadden, covers the portion of the road extending from the connection with the New York division, near North Penn Junction, northeasterly to the Oxford Turnpike, about one mile north of Frankford, a distance of 3½ miles. The construction work is quite heavy, comprising a fill 50 ft. in height at the crossing of Wingohocking Creek, and another about 40 ft. high at the crossing of Tacony Creek. The road is being built for double track in a most thorough and substantial manner, with iron overhead bridges at the points where the city streets have to be carried over the same. At Bustleton, a point about eight miles from North Penn Junction, a connection will be made with the New York division by means of the Bustleton & Holmesburg Railroad, which connects with the Pennsylvania's New York division, at Holmesburg Junction.

The Pennsylvania Railroad is a large owner of real estate near Frankford, having in right of way settlements purchased nearly 200 acres of farm land. It is understood to be the intention of the Pennsylvania to divide this property and sell it for manufacturing sites, in which event it is predicted that as a manufacturing center it will soon rival the vicinity of Germantown Junction, or any other similar section of the city of Philadelphia.

President Roberts has informed a committee from Johnstown, Pa., that his company has been trying to make an arrangement with the Baltimore & Ohio to reach Moxham (Johnstown, Pa.) over that company's tracks, but has not yet consummated it. If the company does not succeed in making such an arrangement within a short time, it will build its own road to Moxham, if the citizens of Johnstown will aid it with favorable legislation.

Surveyors are now running lines on the northern side of the Juniata River from a point above Baileys to West Newport. If this survey be adopted it will necessitate the building of two river bridges but cut off about a mile in distance between Harrisburg and Altoona, beside eliminating the present sharp curves from Trimmers Rock to Newport. Work has been resumed on the cut at Bixler's on the middle division. The track is to be straightened between that place and Denholm. Kerns & Son have renewed work on the new track between Rope Ferry and Millerstown.

Pennsylvania Midland.—Contractor J. W. Rutherford, of New York, who was last week appointed Receiver of the road, is a creditor to the extent of about $30,000. He has asked that certificates for the completion of the road, and payment of certain preferred claims, be authorized by the court to be issued. Mr. Rutherford estimates that it will cost from $125,000 to $150,000 to complete the main line through Bedford County. There are preferred claims of about $50,000.

Pittsburgh & Western.—It is reported that a plan to double-track the new line through Youngstown, O., on the south side of the Mahoning River from Haselton to Niles, may be carried out next year. The double track would be used by passenger and freight trains to avoid heavy grades of the present line on the north side of the river, but the latter track will be retained for handling local freight.

Rockport & Northern.—A charter for this road will be filed in Texas this week. The road will be one of importance, as it will give an outlet through Texas to the Gulf. It will extend from Rockport to Smithville, 145 miles, and connect with the Missouri, Kansas & Texas Railway. It will be built by Baltimore and New York capitalists.

Santa Fe, Oklahoma & Western.—Secretary Lowe, of Oklahoma Territory, has issued a charter to this railroad company. The railroad is to extend from Sapula, I. T., to Vernon, Tex.

Silverton Northern.—Otto Mears, President of the road announces that money has been secured to build a narrow gage line from Silverton, Col., up the Animas River to the summit of the range at Mineral Point, a distance of 5 miles. This road will be completed by July 1, and will no doubt be a profitable line, for many producing mines are developed throughout the entire length of country traversed by this proposed road and the ore in sight promises a heavy tonnage.

Smethport & Olean Railroad.—A charter for this company was filed at Harrisburg on Dec. 5 to build a road from the north terminus of the Mount Jewett & Smethport Railroad, in Smethport, McKean County, Pa., thence northerly and northeasterly through the county to a point on the state line between New York and Pennsylvania, in the township of Eldred, McKean County, Pa. The length of road is about 18 miles. The capital stock is $400,000. George J. Wolf, of Bradford, Pa., is President.

Southern.—The officers now expect to be running trains into Norfolk, Va., the first week in January. Trains will be run over the Wilmington & Weldon from Selma, N. C., to Tarboro, and over the Norfolk & Carolina from the latter point to the new terminal at Banner's Point, on Norfolk harbor. A large force of men is at work on the branch line between Greensboro and Selma, putting in iron bridges and preparing it for heavy through traffic.

Tennessee Coal, Iron & Railroad.—The company is at work with a large force of hands grading and laying about two miles of track from Reeder's Gap to their new ore mine, near Bessemer, Ala., which is said to be very rich, and a large output of ore will be made as soon as the track is completed.

Texas, Louisiana & Eastern.—S. Lazarus, Receiver of the road, announces that the work of extending the road from its present terminus to Silsbee, Tex., will begin soon, probably during this month.

Union Pacific, Denver & Gulf.—The rails recently ordered from the Colorado Fuel & Iron Company, when received, will be used in the repairs of the roadbed north of Denver, Col. This order was for 2,500 tons of 65-lb. rails. This is in addition to other large rail orders given out within a year. During the last year the company has laid new rails on 85 miles of its road south of Denver.

Washington & Columbia River.—It is rumored that the road may be extended from Hunt's Junction to Old Town, Wash., to connect with boats on the Columbia River. A large amount of rails are now being unloaded together with other material for track improvements on the main line out of Walla Walla.

Electric Railroad Construction.

Attleboro, Mass.—The electric lines of North Attleboro, Pawtucket and Attleboro have combined with the Interstate Consolidated Street Railroad. Marsden J. Perry, of Providence, R. I., is President. The roads, which are 24 miles long are all in operation.

Boulder, Col.—The Western Electric Transit and Power Co. has been recently incorporated with a capital of $100,000.

Chester, N. H.—The surveys for the Chester & Derry Electric Railway have been completed.

Cincinnati, O.—The Consolidated Street Railroad has been granted permission by the Board of Aldermen to put in the overhead trolley. This does away with the last horse-car line in this city.

Hagerstown, Md.—The first actual work on the Hagerstown & Potomac Electric Railway was begun last week. A force of men began the work of grading on the Funkstown extension. Three thousand ties to the mile will be laid, and 50-lb. rails.

Hyattsville, Md.—Work on the Washington & Maryland Electric Railway has commenced, and if the weather is favorable the road between the District of Columbia and Laurel, Md., will be running early next summer. The work has been divided between these points into six different sections. The right of way has cost nearly $50,000. About three-fifths of this cost was incurred in getting through Hyattsville. The cars are now being built. They are 40 ft. long, with a seating capacity of about 70 passengers.

Jefferson City, Mo.—Secretary of State Lesueur issued a certificate of incorporation to the Central Railway Company, of St. Louis, with a capital stock of $2,000.

Lima, Peru.—American capitalists have obtained a concession which will allow the construction of electric tramways through the streets of Lima.

Long Branch, N. J.—The trolley company commenced the work of laying its tracks across Broadway and along North Broadway to Long Branch avenue last week.

Memphis, Tenn.—The Citizens' Street Railway Company is repairing its 25 miles of track, and will build four miles in addition. One hundred-pound rails will be used.

Milford, Conn.—A survey has been made for the Milford Electric Railway Company from Saugatuck to Burrie's Point, Merwin's Point and Woodman, a distance of 10 miles.

Mill Valley, Cal.—A line seven miles in length is being projected to be built up Tamalpais Mountain. The preliminary survey of over five miles of the line is completed, and the remainder will be finished soon. There is one tunnel on the proposed line 150 ft. in length.

Montreal, Canada.—Work was started recently on the Napierville Junction Railway, to extend from St. Remi to Stottsville, through the parishes of St. Michel, St. Edward, St. Phillipe, St. Jacques, Douglassville and Napierville. A connection is made with the Grand Trunk at Stottsville. By Christmas the line is expected to be running to St. Edward. Hon. J. G. Laviolette is President, and Mr. Eugene Lafontaine is Secretary. General Riley, United States Consul at Ottawa, is one of the directors. The Dominion Government granted a bonus of $3,200 for each mile, while several parishes also voted sums to assist the building of the line.

The Incline Railway Company has been given permission to complete the work of extending its track to Park avenue.

Parkewood, N. C.—The Glendon & Gulf Railroad proposes to build an extension from Glendon to Parkewood, a distance of seven miles.

Portland, Me.—The Portland & Cape Elizabeth Railroad was put in operation for the first time last week.

San Antonio, Tex.—The San Antonio Edison Railway Company is asking the City Council for a franchise to construct an electric line.

Santa Monica, Cal.—It is reported that surveys are being made for the Los Angeles and San Monica Electric Railway, and that the work will soon be begun.

Sioux City, Ia.—The Central Traction Company has been incorporated to operate a street railroad, with a capital stock of $500,000.

Springfield, Ill.—The ties for the new electric road between Springfield and Acnia, to be built by New York contractors, are being distributed, and the work will be pushed as rapidly as the weather will permit.

Staten Island.—The New Brighton Village Trustees last week granted to the Staten Island Electric Company a franchise in Castleton avenue, Broadway, a portion of the Manor Road and a route to get to the Clove Road, if no arrangement is made with the Midland Company on Columbia street.

St. Joseph, Mo.—The St. Joseph Railway, Light, Heat and Power Co. has been incorporated with a capital stock of $3,300,000.

St. Louis.—Work is rapidly progressing on the St. Louis & Kirkwood electric line. The tracks are laid from Meramec Highlands to Glendale, and from Forest Park to Tuxedo Park, leaving a distance of about three miles where the rails are not laid. The company expects to join the two ends and to have the cars in operation over the entire line before February.

White Plains, N. Y.—The New York, Elmsford & White Plains Railway Co. has filed plans for extensions of the line. The most important of these is from White Plains to Mamaroneck.

GENERAL RAILROAD NEWS.

Atchison, Topeka & Santa Fe.—The railroad and the securities owned by the company were sold at Topeka on Dec. 10, under foreclosure decree to Edward King, C. C. Beaman and Victor Morawetz for the Reorganization Committee for $60,000,000. Attorneys representing St. Louis & San Francisco, and Chicago, Santa Fe & California bondholders filed a protest against the sale. The charter for the new company was filed with the Secretary of State of Kansas immediately on the confirmation of the sale by Judge Caldwell. On Thursday the new Board of Directors met and perfected the organization already agreed upon by the Reorganization Committee. An effort is to be made to have Judge Caldwell consent to the receivers continuing in the operation of the road until Jan. 1, when the new company will come into possession. The present title, "Atchison, Topeka & Santa Fe Railroad Company," will be changed to "The Atchison, Topeka & Santa Fe Railway Company."

Buffalo & Susquehanna.—Articles of merger have been filed in Pennsylvania between the State Line Railroad, which extends from Perryville, Potter County, to the state line between New York and Pennsylvania, and the Buffalo & Susquehanna Railroad, which extends from Galeton, Potter County, to Perryville, the new line to be known as the Buffalo & Susquehanna Railroad Co. The capital is $2,000,000, and the officers are: President, M. E. Olmstead, Harrisburg; Vice-President and Chairman of the Board, Frank H. Goodyear, Buffalo, N. Y.; and C. W. Goodyear, of Buffalo, Vice President and General Manager.

Deer Creek & Susquehanna.—This road was sold at Belair, Md., on Dec. 1, to Mr. Geo. M. Jewett. The road was sold under the mortgage of the Mercantile Trust & Deposit Co. of Baltimore. Some work has been done on the line, and some portions of the road have been graded and right of way secured from Belair to the Susquehanna River.

Denver & Rio Grande.—The percentage of earnings in both freight and passenger business of this company for this year will show a handsome increase over the business of last year. The mining revival in Colorado has not been confined to any particular district, but all portions of the road alike have profited by the increased tonnage of ores. Every branch of the road has probably paid more than the operating expenses, something unusual in the history of the company. The tonnage of ores out of Aspen and Leadville, especially, has been larger than at any time in the history of the company. The expenses of operation will materially increase another year, caused by needed repairs of the road and the rolling stock. The company recently placed an order for 550 freight cars.

Des Moines & Kansas City.—President Hughes and General Manager Goodrich, of the Keokuk & Western, announce that their company has bought and assumed control of this road, extending from Gainesville to Des Moines, 112 miles. This purchase gives the Keokuk & Western a direct line into Des Moines, and a start from Van Wert in the direction of Kansas City and St. Joseph. The road will be changed to standard gage in a short time.

Illinois Central.—The October exhibit shows a very important increase of gross and net earnings over last year, although gross earnings were $420,000 less than in 1893, and net earnings $217,000 less, which was the World's Fair time. A moderate increase in expenses was made. Details follow:

October:	1895.	1894.	Increase.
Gross earn	$2,248 816	$1,841,814	$107,032
Oper exp	1,281,005	1,270.650	10.355
Net earn	$967,841	$571,164	$396,677
Since July 1:			
Gross earn	$7,126 660	$6 234,489	$892 171
Oper exp	4 704,851	4,614,043	90,808
Net earn	$2,421,809	$1,620,446	$801,363

The gross earnings for November were $1,972,243, an increase of $130,212. Since July 1, gross, $9,098,903, an increase of $1,022,383.

Kentucky Midland.—The road was put up at Receiver's sale at Frankfort, Ky., on Dec. 2, under a recent order of court, but no bids were received, and the sale was adjourned. Under the order of sale the upset price was fixed at $320,000.

Lehigh Valley.—Messrs. Edward B. Smith & Co., of Philadelphia, have purchased from the company $1,500,000 Pennsylvania & New York Canal and Railroad Co. 4½ per cent. consolidated mortgage bonds, maturing April 1, 1939. These bonds are guaranteed for principal and interest by the Lehigh Valley, and will be issued in retirement of a like amount of 7 per cent. bonds, maturing June 1, 1896. The consolidated mortgage is for $10,000,000, of which $7,000,000 have been issued at 4 and 5 per cent. and $3,600,000 were retained to retire the first mortgage 7s at maturity. It is a part of this $3,000,000 that has just been sold. The company will save $37,000 annually in interest charges by the transaction.

Macon & Birmingham.—The date for the foreclosure sale of the road has been fixed for Dec. 20, and the sale will take place at Macon, Ga.

Marietta & North Georgia.—After repeated efforts on the part of the North Carolina Railroad Commissioners to secure the annual report of this road, and the

officials having refused to furnish the Commission with it according to the requirements of the North Carolina law, the Commissioners have instructed the State's Solicitor, of the Twelfth Judicial District, to institute suit against the company and collect the penalty prescribed by law for such neglect or refusal.

Montgomery & Eufaula.—This road was sold at foreclosure at Montgomery, Ala., on Dec. 7, and was bought for Messrs. Thomas and Ryan, of New York, representing the reorganization committee of the Central of Georgia. The price was $500,000. This is the last of the roads of the old Georgia Central Railroad, to be sold, and it is understood that there will be no change in the management, the road still being part of the system to be operated as heretofore.

New York, Pennsylvania & Ohio.—Daniel Babst, Jr., of Crestline, O., was appointed Receiver of the road by Judge Norris, of Common Pleas Court, at Marion, O., on Dec. 8. John Todd had been appointed Receiver by the Summit County Court, but Judge Norris held the action was taken without jurisdiction.

Norfolk & Western.—The following is the report of earnings for November and the ten months:

Month of November:	1895.	1894.	Inc. or dec.	P. c.
Miles operated	1,570	1,567	I.	3
Gross earn	$971,595	967,570	I. $4,024	
Exp., including taxes	764,422	707,430	I. 56,991	= 8
Net earn	$207,173	$260,140	D. $52,967	= 20
P. c. of exp. to gross earn	79	73		
For 10 months to Oct. 31:				
Gross earn	$7,828,733	$8,552,510	D. $723,777	= 8
Exp., including taxes	6,120,684	6,335,801	D. 215,117	= 3
Net earn	$1,708,049	$2,216,709	D. $508,660	= 23
P. c. of exp. to gross earn	78	74		

Pennsylvania & New Jersey.—The railroad company, a subsidiary organization of the Pennsylvania, which is constructing the bridge over the Delaware that is to carry the Pennsylvania's trains through from New York to Atlantic City and Cape May, will, on Dec. 19, increase its capital stock.

Philadelphia & Reading.—The Olcott-Earle Reorganization Committee, it was announced last week, has formally approved the sub-committee's plan of reorganization. Copies of the plan have been sent to London, and it is expected that publication of the details will be made simultaneously in New York and London It is expected that J. P. Morgan & Co. and other banking firms will underwrite the plan. It is understood that under this plan the first mortgage bondholders will receive the arrears due them and will control the property for a time. The preferred incomes will be assesseed 20 per cent., but with allowances in the new issue for claims of relative priority in the income bonds. The common stock will be assessed 20 per cent., and will then receive new stock at par. The income bondholders oppose the plan.

The reorganization committee, which has prepared the plan, is as follows: Frederic P. Olcott, Adrian Iselin, Jr.; J. Kennedy Tod, Henry Budge and Thomas Denny, of New York, and George H. Earle, Jr.; Sidney F. Tyler, Samuel B. Shipley and Richard Y. Cook, of Philadelphia.

Southern Pacific.—The earnings for October are as follows:

	1895.	1894.	Inc. or dec.
Gross earn	$5,578,545	$5,670 836	D. $92,291
Oper. exp.	3,123,254	3,229,639	D. 106,385
Net earn	$2,455,291	$2,441,197	I. $14,094
Gross 10 months	42,960,468	41,306,975	I. 1,654,993
Net 10 months	13,946,334	13,836,867	I. 109,467

Electric Railroad News.

Detroit, Mich.—Mayor Pingree issued an address to the people last week in which he declares that the Citizens' Street Railway Co. must abandon its five cent fare; sell eight tickets for a quarter, with universal transfers interchangeable with the tickets of every other road in the city; must allow joint use of its tracks within a mile of the City Hall by other roads, and must permit municipal ownership of its tracks at any time when appropriate legislation can be obtained for that purpose.

Hagerstown, Md.—The Hagerstown and Potomac Electric Railway Company has filed for record a mortgage of $200,000 to secure an issue of bonds to build the railway. The Harrisburg Trust Company is named as the trustee.

Kingston, Canada.—A judgment of foreclocure in the matter of the Colonial City Electric Railroad Company was granted by Judge Parker on Saturday. The amount due upon the mortgage amounts to a little over $170,000 for principal and interest.

Newark, N. J.—The Union Traction Company is to go into the hands of a receiver for a debt of $166.66 for office rent. The company was organized only a year ago, and capitalized at $1,500,000.

New Haven, Conn.—Judge W. K. Townsend, in the United States District Court, last Saturday, gave a decision in the suit of the Thomson-Houston Electric Company against the Winchester Avenue Street Railroad Company for the latter. The case was really an issue between the General Electric Company and the Westinghouse Electric Company for an adjudication of the Vanderpoel patents, covering the overhead trolley. The case will go to the Circuit Court of Appeals.

New Jersey, N. J.—M. E. Davis has been appointed General Manager of the New Jersey Electric Railway Company.

New Orleans, La.—Bids are invited until March 3 for the purchase of a 50-year franchise for a street railroad.

Ottawa, Ill.—The Ottawa Electric Street Railway, including all real and personal property, was sold recently by Receiver A. L. F. Schoch to the General Electric Company, the only bidder, for the nominal sum of $7,500

Philadelphia.—It is reported that a syndicate here has bought the Long Island City trolley and electric light lines. There are about 60 miles of trolley road in operation.

Toronto Junction, Ont.—Tamblyn & Gibson, of this place, have the contract for extending the Suburban Electric Railway to Weston.

TRAFFIC.

Traffic Notes.

The Louisville & Nashville made a rate of $5 round trip from Nashville to Atlanta on the occasion of Tennessee Day at the Atlanta Fair.

The Trunk Lines have agreed to advance the freight rate on anthracite coal to Chicago and other western points to $4 a ton, an increase of 50 cents.

The competition between the Southern Pacific Railroad and the steamship lines for traffic between San Francisco and Portland has now extended to freight as well as passengers, and the freight rate by steamer is only $1 a ton.

The Denver & Rio Grande now runs a passenger train from Denver to Cripple Creek and from Cripple Creek to Denver, nightly, to accommodate the increase of business incident to the gold mining excitement. These trains have three sleeping cars each.

One day last week the regular through train from Portsmouth, Va., to Atlanta, over the Seaboard Air Line, was operated in 12 sections. On another day the same road hauled 2,300 passengers from Portsmouth to Atlanta. Most of them came from Baltimore.

The Oil Exchange of Los Angeles has made a contract for the construction of an oil tank at San Pedro, Cal., to hold 15,000 barrels. San Pedro is on the coast and this tank is to store oil to be shipped by vessels to San Francisco. Two large receiving tanks are to be built at the latter city.

A traffic officer of the Chesapeake & Ohio tells a reporter at Cincinnati that during the past two months that road has taken 500 cars of coal a day into that city. The movement of coal over this road has been heavy during the entire eight months that the Ohio River has been too shallow for navigation, and the road takes the credit for the fact that there has been no scarcity of coal at Cincinnati and no advance in the price.

The Erie and other canals of New York State were closed on Dec. 5. The State Superintendent of Public Works says that the number of tons of freight carried on all the canals of the state during the past season was about 10 per cent. less than in 1894, when the total was 3,882,560 tons. There have been only three breaks during the past season which interfered with navigation, but boats were delayed somewhat by low water.

The Kansas City Freight Bureau has withdrawn its request for lower rates on grain from Nebraska points, and will not carry into effect the proposed "boycott." The Bureau brought pressure enough to bear upon the Union Pacific to induce that line to agree to a readjustment of rates which would place Kansas City on an equal footing with St. Louis, but the other Nebraska lines refuse to become parties to the agreement, and they will withdraw all tariffs from Nebraska to Kansas City if the commission men persist in their demand; consequently, the commission men decided it was better to take what they could get than bring on a fight of this kind.

At Chicago, Dec. 5, W. S. Forrest, on behalf of John A. Hanley and Isaac Thompson, filed a motion in the United States District Court to dismiss the indictments found against his clients in October, 1894, when Joseph W. Reinhart and John A. Hanley, officials of the Atchison, Topeka & Santa Fe, and Isaac Thompson, of Kansas City, and Nelson Morris, of Chicago, shippers, were indicted by the Federal Grand Jury for a violation of Section 10 of the Interstate Commerce act, which section prohibits rebates to shippers. Reinhart and Hanley were indicted jointly, and Thompson and Morris separately. Mr. Forrest presents 32 reasons for quashing the indictments. The motion will not be argued before the holidays.

"The Erie Railroad Company" began business Dec. 1, and General Passenger Agent Roberts has given notice that certain tickets for passage between New York and Buffalo, issued by the old New York, Lake Erie & Western Railroad Company, will not be recognized by the new company and are void. These tickets, about 500 in number, are part of an issue of 2,500 made at reduced rates during a passenger war some four years ago. Mr Roberts has made every effort to redeem the tickets, and has offered face value for them, but they were sold to scalpers and the old company was not able to get in more than about 2,000 of the original issue. It is known that they are nearly all owned in Buffalo, and that in some instances the banks of that city have lent money, taking the tickets as collateral.

The Interstate Commerce Commission has announced its decision on the case brought by F. J. Daniels against the Rock Island and the Great Northern, involving discrimination in rates between Sioux City, Sioux Falls and Duluth. The word "line," as used in the statute, means a physical line The law requires regulation of railroad charges according to the ascertained rights of persons and places; it is not an agency for the regulation of trade by robbing shippers and communites, or to put them on even terms with rivals more remote from competitive territory. The relative equality enjoined by the statute requires substantial modification of the present disparity in rates from Chicago to Sioux City and Sioux Falls, and under present conditions such disparity in rates from Duluth to Sioux City and Sioux Falls should be discontinued."

The Little Rack & Memphis case against the East Tennessee, Virginia & Georgia, which was decided by the Interstate Commerce Commission more than six years ago (March 25, 1889), has just received its final quietus, the U. S. Supreme Court, to which an appeal was made, having dismissed the case for want of jurisdiction. The Little Rock & Memphis, which has a direct line between the cities named, tried to get the East Tennessee to sell tickets over this line and thence onward to points further west over the St. Louis, Iron Mountain & Southern, and the latter road was made a defendant in the case, but the Iron Mountain also has a line from Memphis to Little Rock (an older one), and naturally desires all of the traffic to go the whole of the distance over its own line. The decision of the Commission, written by Mr. Aldace F. Walker, held that the Interstate Commerce Law was probably intended to provide for the relief of intermediate roads in a through line, situated as the camplainant was in this case, but that the law did not provide the necessary machinery to carry the intention into effect, and no relief was granted. The Little Rock road subsequently applied to the courts for an injunction, but the Circuit Court in the Western District of Tennessee dismissed the bill.

Chicago Traffic Matters.

CHICAGO, Dec. 11, 1895.

At the meeting of the Executive officers of the roads members of the Central Traffic Association last week, it was practically admitted that some of the lines were not maintaining rates on provisions eastbound and a resolution was adopted that on and after Dec. 9, agreed tariff rates must be strictly maintained.

There have been rumors that the Central Traffic Association would be disbanded and all business made subject to the new Joint Traffic Association. It is not probable, however, that any such action will be taken. There are so many diverse interests in the territory lying west of the western termini of the Trunk Line Association, that it will be impossible to handle the traffic satisfactorily unless an organization is kept up at this end

The Chicago Freight Bureau and the Chicago Board of Trade are persistently pushing their demands upon the Ohio River Lines for better rates to Southern territory. It is generally admitted that the Ohio River Lines would be glad to join in any arrangement which would tend to increase traffic from Chicago to Southern points, but are prevented from doing so by the Southern Traffic Association, which ignores all requests made for a better rate schedule. The Freight Bureau Association people, however, are confident that they will be able to bring pressure enough to bear upon Southern Lines to induce them to reconsider and allow the Ohio River Lines to make any rates which will better that territory to Chicago markets.

General Passenger Agents of the Colorado-Utah roads are at work this week perfecting an agreement to govern passenger traffic in this territory. It has never been found practical to include the Colorado and Utah business in either the Trans-Missouri or Trans-Continental Associations, and it is probable that an independent association will be formed with a chairman having his headquarters at Denver.

The Chicago & Eastern Illinois has arranged with the Louisville & Nashville for a fast train to be put on Dec. 15, making the run from Chicago to Nashville in 12 hours and 30 minutes, a saving of 1 hour and 38 minutes over the present time.

Central Traffic roads, as expected, failed to agree upon a clearing house for handling clergymen's half-fare permits, and it was decided to make a rate of half the regular fare, with the proviso that such rates shall not amount to less than 1½ cents. a mile Certificates will be issued by individual lines as heretofore.

Several meetings between the large Chicago shippers and representatives of Illinois roads have been held recently, looking to a better adjustment of interior state rates with a view to protecting Chicago against competition from Indianapolis, Detroit, Cincinnati, etc. It was expected when the recent changes were made in Illinois freight classification at the command of the State Board Railroad and Warehouse Commissioners, and which were agreed to by both shippers and railroads, that a long standing difficulty would be removed. It turns out, however, that there are still some advantages in favor of the interstate business as against the intra-state business.

The Advisory Committee of the Western Immigrant Clearing House has appointed a committee to meet representatives of the Southern Pacific in New York as soon as possible, with a view to agreeing upon a percentage of the business to be allotted the Southern Pacific, on condition that it becomes a member of the Clearing House agreement and stops diverting business via New Orleans, as is now claimed.

Central Traffic Association lines have been unable to agree upon a charge to be made for the transportation of bicycles in baggage cars, and the matter has been referred to the committee.

Eastbound shipments last week increased largely, particularly in grain and provisions, and there are reasons for believing that cut rates were a considerable factor in the increase.

The shipments of eastbound freight, not including live stock, from Chicago, by all the lines for the week ending Dec. 7, amounted to 72,672 tons, against 58,312 tons during the preceding week, an increase of 14,360 tons, and against 45,433 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	Week to Dec. 7.		Week to Nov. 30.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central	11,181	15.4	8,102	13 9
Wabash	5,895	8.1	3,417	5.9
Lake Shore & Mich. South.	9,124	12.6	9,384	16.1
Pitts., Ft. Wayne & Chicago	9,139	12.7	5,158	8 8
Pitts. Cin., Chi. & St. Louis.	8 469	11.6	6,441	11.0
Baltimore & Ohio	7,138	9 8	6,538	11.2
Chicago & Grand Trunk	3,119	4.3	3,001	5 2
New York, Chic. & St. Louis	8,321	11.4	7,956	13.7
Chicago & Erie	5,775	7.9	5,099	8.7
C., C., C. & St. Louis	4,570	6.2	3,216	5.5
Totals	72,672	100.0	58,312	100.0

Of the above shipments 3,921 tons were flour, 33,361 tons grain and mill stuff, 15,825 tons cured meats, 9,210 tons dressed beef, 1,217 tons butter, 1,607 tons hides, and 5,092 tons lumber. The three Vanderbilt lines carried 39.4 per cent., the two Pennsylvania lines 24.3 per cent.

Decline of Traffic on the Mississippi River.

The stockholders of the Mississippi Valley Transportation Company will hold a meeting on Jan. 14 to vote upon the proposition to decrease the capital stock of the company from $2,000,000 to $500,000. President Henry C. Haarstick, when askedas to the cause of the proposed action, said:

"This is the beginning of the end. Mississippi River traffic is no more what it used to be and is continually growing less. The company was organized in 1867, with a capital stock of $250,000. I have seen the time when every one of our 60 barges was loaded to the water's edge with wheat, corn, oats, or merchandise, bound for Southern points along the river. It was nothing for our company to handle over 500,000 tons of freight in one year. Failure to deepen the channel of the Mississippi River has caused this falling off in business. The losses in river traffic in the past 18 months were owing largely to the extreme low water. A great deal of money has been spent by the Government and little good accomplished. We need seven or eight good dredge boats to dredge the channel of the river during the low-water period. About $20,000,000 has been spent by the Government in experimenting and skirmishing, but no definite benefits have been derived, as far as navigation is concerned. I understand that a strenuous effort will be made to attract the attention of Congress this winter to the present condition of affairs."
—*St. Louis Globe-Democrat.*